Engineering News-Record

Devoted to Civil Engineering and Contracting
McGRAW-HILL COMPANY, INC.

July 11, 1918

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New York State Highway Department

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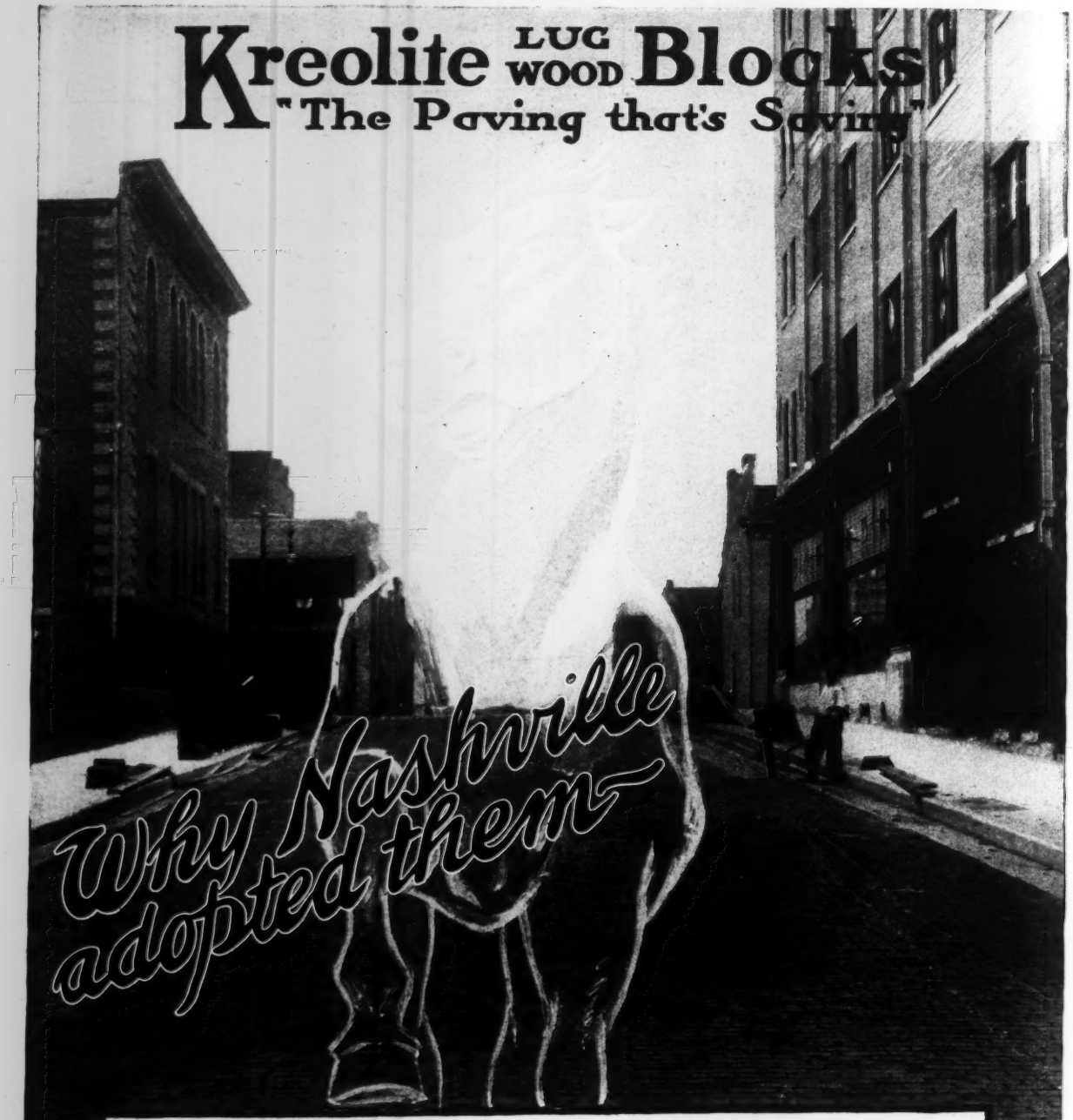
Kreolite LUG WOOD Blocks

"The Paving that's Saving"



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Volume 81 July 11, 1918 Number 2

Engineering News-Record

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E. J. MEHREN, *Editor*
CHARLES WHITING BAKER, *Consulting Editor*

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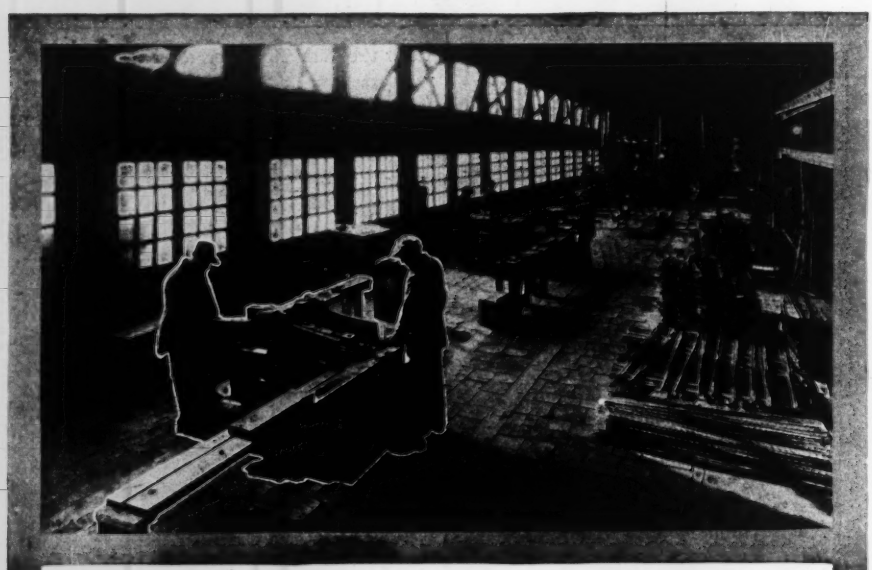

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To Concrete Contractors:

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A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. Mehren, *Editor* — Charles Whiting Baker, *Consulting Editor*

Volume 82 — NEW YORK, THURSDAY, JULY 11, 1918 — Number 2

Zone Postage Not to Affect Subscription Price

NEW rates of postage on magazines which went into effect July 1 will cause material increases, especially at distances of more than 300 miles, in the cost of supplying *Engineering News-Record* to its subscribers. The obvious action for the publishers to take is to raise subscription rates in distant zones to cover the added postage. For the present, however, it has been decided not to increase the subscription price, trusting Congress will restore the flat-rate system in the interest of national unity. Zone rates on magazines, which obtained in this country before the Civil War, were abolished in 1863. It is to be hoped that the publishers will not find it necessary to increase the cost of the paper to its readers.

Movies May Help Designing Engineers

SOME years ago several educators independently of one another suggested the use of the moving picture as an adjunct to student instruction. The possibility of presenting in the classroom the orderly sequence of certain operations was obviously superior to any other method of visual impression. If the method has been used with any great success, little notice has been taken of it; but a recent use of the moving picture in a similar field is proving quite successful. The concrete ship department of the Emergency Fleet Corporation has had a number of moving pictures taken of various yard operations in some of its remote plants where concrete ships are under way. These pictures are reproduced regularly for the benefit of the designing force in the home office in Philadelphia, with the idea of impressing on that force the many construction details which otherwise they would have to imagine and also of pointing out particular difficulties met with in the field with which the designer not only should be conversant, but to meet which he should change his future design. In these days of large central offices and outlying construction work, the idea may prove valuable to other concerns.

Pavement Cost Data Is Often Misleading

DIFFICULTIES involved in determining the cost of pavements in relation to the tonnage carried are shown in an article in this issue by C. D. Babcock. Present information is hard to analyze and results which are seemingly contrary to reason are often reached. This is evident when Mr. Babcock is forced to conclude "that the traffic tonnage has relatively small influence on the ultimate cost of waterbound macadams." Such a finding is apt to be misleading unless the quality of traffic and the peculiar characteristics of the pavement are carefully considered. Waterbound macadam is designed to carry light, slow-moving traffic, such as horse-drawn vehicles; and for this service it is excellently fitted. Its inherent defect is its well known susceptibility to destruction by high-speed motor traffic. One pneumatic-tired automobile, weighing only a ton, will do more damage to the average waterbound surface than loads of four times that amount, traveling at low speeds. We might expect on highways where a large percentage of the traffic is light and travels at high speed, that the effect of its weight would be relatively small when compared with this and other destructive agencies. If the data were such that it might be readily separated into tonnage classes, the heavier classes would probably show a different result. As Mr. Babcock says, the conclusions reached cannot be considered as holding for other roads under widely varying conditions. The fact stated so often in these columns, that intensive study of paving problems is desirable, is emphasized anew by Mr. Babcock's article.

Imhoff Tank Shutdown at Baltimore Explained

RUMORS and questionings about the shutting down of the Imhoff sewage tanks at Baltimore, the largest installation of the kind in America, have been numerous for some time past. The truth of the matter, with corrections of some misleading statements, as given on p. 84 by Mr. Pitts, until recently engineer in charge of the installation, will doubtless be welcomed by a host of sanitary engineers. Although some of the happenings at Baltimore are local in their bearing the general conclusions as to Imhoff tank design reached by Mr. Pitts deserve careful attention.

Mitchel, a Pattern for Municipal Administrators

THE nation suffered a serious loss in the death last week of John Purroy Mitchel, major in the aviation service, late mayor of New York. He was of the type of young men who, standing on a platform of efficiency and honesty, are ready to do battle against entrenched political organizations. The nation had not felt his hand directly as a public official, but surely the example he gave of good civic government in New York must have been an inspiration to communities and the young men in political life throughout the land. Today, in the hour of his death, all parties in New York, all the newspapers, attest that his administration was one of the best the city has ever known. And yet he

was young when he came to the mayorality of the country's largest city. Only 35 then, he won the respect and support of the solid elements of the community. Schooled by eight years of service in responsible positions in municipal government, he entered the mayor's office with an intimate knowledge of city administration. He gathered about him men who were not only experts in the duties assigned but effective administrators also. He inspired them with his views as to the service which a city should render its people. Above all he was not afraid to fight when the cause was good. This fighting spirit he carried to the army, choosing a service where he could get into action with the least delay. Had he lived, the nation would surely have come to know him as New York did. Engineers have a special reason for honoring him, for he believed in them and in their methods, and never failed of an opportunity to show his approval of their work. He was the type of official that we shall have more of in the future, when municipal administration shall have been raised to the dignity of a profession, when experts rather than political machines will direct civic activities.

The Railroad Valuations Again

WHAT about the railroad valuations? This question was asked by *Engineering News-Record* a short time ago, and valuation engineers were urged to give the public the benefit of their expert opinions. For reasons best known to themselves they have not expressed themselves to this journal in large numbers, but the responses of a few agree closely and point to rational conclusions.

The valuation work should not be dropped, despite the defects in the Valuation Act, the certain degree of wastage of effort in the present method of doing the work, the unsatisfactoriness from the companies' viewpoint of the tentative valuations thus far reported. Some think the work should be suspended during the period of the war, but a more general belief seems to be that where the inventory of a road has proceeded very far it should not be suspended even temporarily.

More than one valuation engineer thinks the work from the start could have been done more efficiently in some different manner—probably with the railroads themselves making their own valuations, and the Government merely checking them. The coöperative system has been developed to quite a high degree in some sections, however, and there is probably ample warrant for the opinion that an attempt to change the system now would result in chaos.

This journal's conclusion is that with all its faults the valuation is a good thing. Most of the valuation men appear to think the data they are getting are well worth the cost of compilation. The companies have assembled information about their property that they never had before, information useful for many purposes other than valuation. And with the whole future of the railroads uncertain it is highly important that the Government and the companies put themselves in a position to be able if the occasion demands to say what the railroad properties are worth. The valuations will at least help materially in that.

City and State Programs for the Coming Reconstruction Period

MUNICIPAL war programs were advocated by this journal in its issue of Jan. 3. The plea was that every city should consider each proposed expenditure and improvement project in the light of war conditions and thus insure, on the one hand, the execution of all really necessary work and, on the other, the postponement of such expenditures as are unnecessary. A three to five-year war program for each city was suggested, so that if happily the war were soon over the inevitable reconstruction period would find the city with a plan. Although but few comprehensive war programs have been adopted the municipal surveys published in *Engineering News-Record*, July 4, p. 33, show that the subject has received consideration and that action has been taken along some of the lines detailed in the editorial. Far more should be done, and that at once, or our cities will not be able—or will be less able—to meet the vast and complex problems that will follow the war.

Recently a number of commendable proposals for municipal reconstruction have been made. Thus, at the meeting of the American City Planning Institute at St. Louis, in May, a resolution was passed urging "the governing bodies of the various States and the Mayors of the various cities" to undertake the planning of public works with a view to meeting post-war industrial conditions. Subsequently, the National Municipal League authorized the appointment of a committee to study reconstruction problems and suggest lines of action to the executive committee of the League. Now comes the Chicago *Tribune* with a printed suggestion for immediate, concrete action. It urges that the city council at once provide a commission of reconstruction. In other words, it applies locally what this journal and the two associations mentioned have advocated for the cities of the nation.

It would be the duty of Chicago's reconstruction commission to consider now the works that should be undertaken when peace comes, to prepare plans for these projects, secure their approval, and, in general, dispose now of all the preliminaries, so as to be ready to make the dirt fly promptly but according to a well-defined program. As the *Tribune* well says, addressing the people of Chicago: "Let us not drift and then in the eleventh hour hastily improvise measures to meet conditions we should have foreseen. Our main business is to win the war. But we can do that and prepare for peace, too."

The State of Illinois, incidentally, is already showing intelligence in planning such as the *Tribune* suggests for Chicago and the two associations had in mind for the country at large. A bond issue campaign, to secure popular approval for a $60,000,000 road program, is now in hand. The proposal will be voted on in November, *but the money is not to be expended until after the war.*

Toledo, as the municipal survey from that city on p. 37 shows, has a reconstruction program well started. It is maturing plans for public works which would provide employment for its quota of returned soldiers.

Other states and cities might well take pattern from Illinois, heed the words of the Chicago paper, and follow the examples set by Toledo and other cities already hard at work on reconstruction programs.

Speedy Disintegration Not to Be Feared in Concrete Ships

TWO weeks ago there appeared in newspapers throughout the country a news note from Atlantic City stating that Rudolph J. Wig, chief engineer of the Concrete Ship Department of the Emergency Fleet Corporation, speaking before the American Concrete Institute, said: "The Government concrete ships are expected to disintegrate. All we are counting upon now is that they will last at least one and probably three years." Coming from one in authority in the Governmental agency that has let $40,000,000 worth of contracts for such ships, this naturally caused some consternation. If the life of a concrete ship is so definitely limited, the large concrete ship program would be most closely scrutinized and the value of such ships after the war is nothing. Much good thought and effort among engineers would be going to waste.

Fortunately, the note and its alarming prediction are subject to doubt. Members of the staff of this journal were in attendance at all the meetings at Atlantic City two weeks ago and no such remark as the one attributed to Mr. Wig was heard from anyone on the floor of the conventions. Furthermore, Mr. Wig expressly denies having made any such assertion. His prepared paper, a portion of which appears in this issue of *Engineering News-Record*, contains no such radical statement. On the contrary, there appear the sentences: "We do not anticipate any trouble from chemical disintegration except as the hull may be seriously abraded. We estimate the life of a concrete ship without any special protection at several years, and known methods which can now be applied should extend the life several years longer. We believe adequate protection will be developed to insure reasonably permanent life to the concrete ship."

The life of a concrete ship depends, more than on any other thing, on something about which we have little knowledge; that is, the ability of the hull to withstand the rack and the wrench of the sea, the terrific strains and twists imposed on a rigid structure under reversal of stresses and suddenly applied loads. Computations of great elaboration based on the best naval architectural knowledge of the day have been made to take care of just these conditions of stress. Scientific foresight has done its best, but so far our sole practical information on the subject is the behavior of the "Faith" on its exceptionally rough voyage up the Pacific about six weeks ago. Minor defects, due to obviously weak design, appeared, but structurally it survived this most severe test and as a ship it received the commendation of the Lloyds agent who was aboard.

Possibly one of the new concrete ships will break its back in its first storm. Steel ships have been known to do so. Possibly, but hardly probably, it may make its first port with so many and serious cracks as to incapacitate it for future service. But these things will not mean a life of one to three years; it will be a question of days or weeks. Assuming the ability of the ship to stand up under such conditions, the good concrete we now know how to make should guarantee a ship's life of indefinite length. Early disintegration, the mortal disease of the Atlantic City dispatch, need not be considered.

Sea water has had a deteriorating effect on certain concretes in the past, but, properly made and protected, no such trouble is to be anticipated in ship concrete. Such concrete must be made dense to attain the necessary high strength. It is not subject to abrasions which will expose the steel or the possibly vulnerable subsurface concrete, except in above-water parts which are readily inspected and repaired, and it will be protected by a surface paint. Furthermore, there will be some sort of anti-corrosion coating on the steel. In the light of our present knowledge, these precautions assure its immunity from saline attack, always provided that the concrete is a first-class product.

Concrete ocean-going ships are radically new, and all new things in engineering must ultimately stand or fall on their behavior in service. So far as theory goes, it can now be definitely stated that the concrete ship can be designed more accurately than has been the custom with the steel ship. As for practice, in one case at least a concrete ship has been built that can withstand the battering of high seas. While one would be rash indeed to insist on the impossibility of its failure, no one can restrict its possible life to a short and definite term of years, and certainly no one can predict its failure from disintegration within a period of economic use.

Unfairness Promoted By Too Many Laws

THOUGH jurisprudence postulates that ignorance of the law is inexcusable, the lay mind finds itself bewildered while trying to thread the maze of legal verbiage of most laws in an attempt to understand their meaning. This bewilderment is increased when it is found that there are two or three different laws in force at the same time all of which aim at governing the same condition. A striking example of this state of affairs is described on page 95. Mr. Robbins explains, briefly, the provisions of three different laws which were framed for the purpose of relieving conditions due to the war, as they affect the performance of public contracts in New York State.

The laws are drawn from different viewpoints, and their administration is left to the discretion of the various department heads. Thus one department can give a certain degree of relief to one contractor, while another can give greater relief to another for the same class of work; all depending upon which law he elects to utilize. It further appears that the state courts have ruled that departments are within their rights in using the laws giving lesser relief.

To say the least, this appears to be unjust discrimination. Present conditions in contracting are unprecedented, and with contracts let before the war, could not be foreseen. To force contractors to complete work at pre-war prices, places the party of the first part in the position of "getting something for nothing." No just person desires this, and no official can in justice require it. Public officials should use every lawful means to enable contractors to complete public work, but at the same time, all of the contractors should be treated alike, regardless of which department supervises their work.

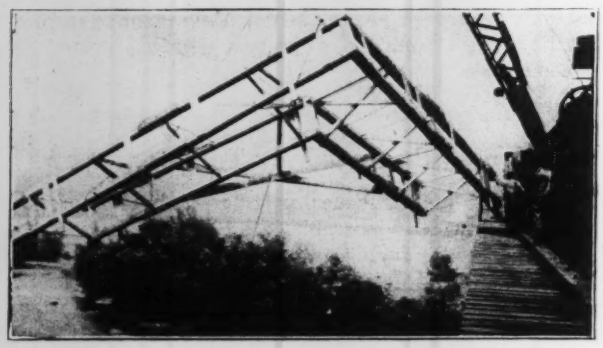
Foundations, Forms and Concrete Distribution Mark Bridge Construction

Cofferdam Leakage Presents Problems in James River Concrete Arch Bridge—Combination Unit Wood and Steel Forms and Steel Arch Centers Used Many Times—Concrete Distributed by Two Types of Car

By Edward W. Stearns
Resident Engineer, James River Belt Line Bridge, Richmond, Va.

CONSTRUCTION of the new James River Belt Line Railway reinforced-concrete arch bridge at Richmond, Va., now fast approaching completion, required unusual precautions to keep tight the shallow cofferdams in the swift current over a boulder bottom, and involved repeated use of special wood and steel forms and arch centers and the distribution of concrete in special cars running on an old steel bridge adjoining.

The bridge was described in *Engineering News-Record* of July 12, 1917, p. 73. It is being built jointly by the Richmond, Fredericksburg & Potomac R.R. and the Atlantic Coast Line R.R. where the belt line connecting the two roads crosses the James River about four miles west of Richmond. It replaces on the same grade an immediately adjoining old steel bridge. The new bridge is of reinforced concrete throughout, 2278 ft. long and 32½ ft. wide. In addition to semi-circular 60-ft. arches at the abutments, the main spans consist of twelve 116-ft. and three 122-ft. double-rib, open spandrel, five centered arches with 58-ft. rise, 10 spandrel posts rising from each arch to the under side of the 15-in. deck slab. Upon the slab there will be 2 ft. of fill and 18 in. of ballast. Every third pier is an abutment pier 20 ft. thick, the intermediate piers being only 14 ft. thick. It is estimated that the finished structure will contain 20,000 cu.yd. of 1:2½:5 concrete in the foundations, piers and the umbrella extensions from the piers to the arches; 21,400 cu.yd. of 1:2:4 concrete in the arch ribs, spandrel slab, etc., and 1,500,000 lb. of steel rods.

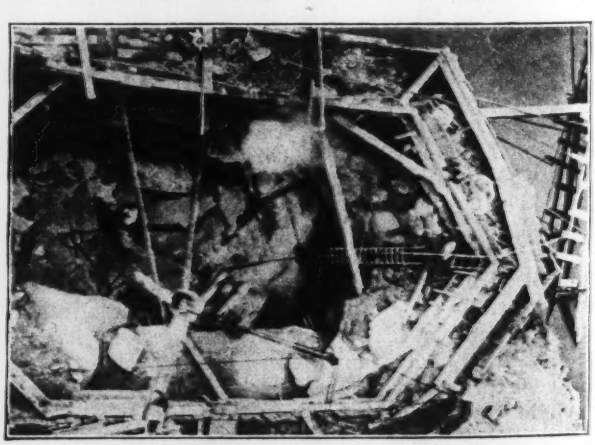


FRAME FOR HALF COFFERDAM WAS SLUNG INTO PLACE FROM ADJOINING BRIDGE

All foundations bear upon granite, which so evidently lies just below the water that it was not considered necessary to make test borings. The river bed is so completely covered with large boulders that at low stages one can almost cross on top of them to an island in the center. At this island, however, an old loose rock and timber dam crosses the river in a diagonal direction, so that the water level in the north half of the river is about 6 ft. higher than in the south half. Partly on account of the very swift current, both above and below the dam, and also on account of the presence of so many boulders, a great deal of care had to be exercised in the construction of the cofferdams.

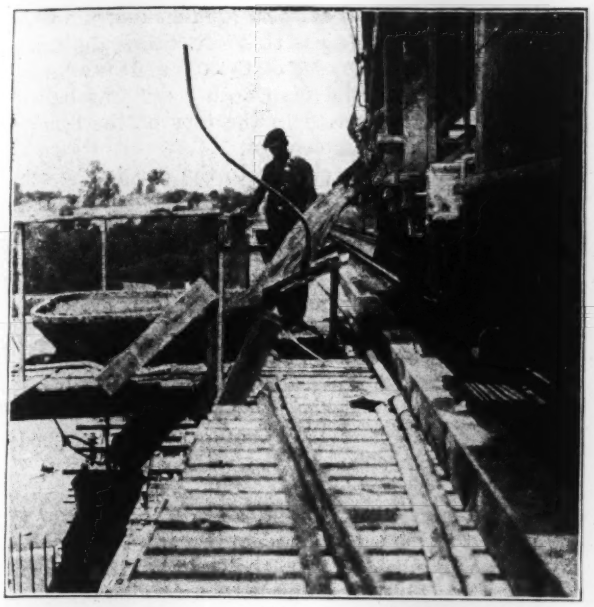
These are all of double walled timber-frame construction, with 8 x 8-in. timber wales, 2-in. sheathing, and a 6-ft. clay puddle between the walls. No serious trouble was encountered with them until the foundations for Piers 6, 7 and 8 were reached. Here the water was about 8 ft. deep, and, on account of the bottom being overlaid with boulders and gravel, it was impossible to drive the sheathing sufficiently to seal the bottom of the puddle. Here the sheathing was adzed off to a feather edge and driven until it took more or less the contour of the boulders. Burlap bags, partly filled with clay, were then carefully placed around the bottom of the inside row of sheathing, and rammed into all the crevices with 2 x 4-in. timbers; at the rods through the puddle these bags were filled one on top of another until they came up to the bottom rod, and to prevent scouring through the puddle along the rods all of them were wrapped either with a small piece of burlap or a wisp of hay. The puddle was then placed in layers about 1 ft. thick, and each layer was allowed to settle before the next one was placed.

With the cofferdams built in this manner, very few leaks developed, but, when they did start, a very quick and effective way of stopping them was found to be to drive a good-sized hole in the puddle above the leak and ram in quantities of excelsior. This swelled very quickly



BROKEN ROCK INSIDE COFFERDAM SOMETIMES LEAKED AND REQUIRED SPECIAL PATCHING METHODS

as soon as it reached the water and at the same time acted as a filter. It usually stopped the leak permanently. In none of the foundations was more water met than could easily be taken care of with a 3-in. Pulsometer pump, although there was always kept on hand on the



CONCRETE WAS DUMPED INTO SPECIAL CAR ON OLD BRIDGE LEADING TO CHUTE TO NEW WORK

cofferdam, ready for emergencies, a 4-in. Pulsometer, a 3-in. gasoline-driven centrifugal, and a 6-in. steam-driven centrifugal pump. These were used chiefly to unwater the excavation quickly, when starting work in the morning

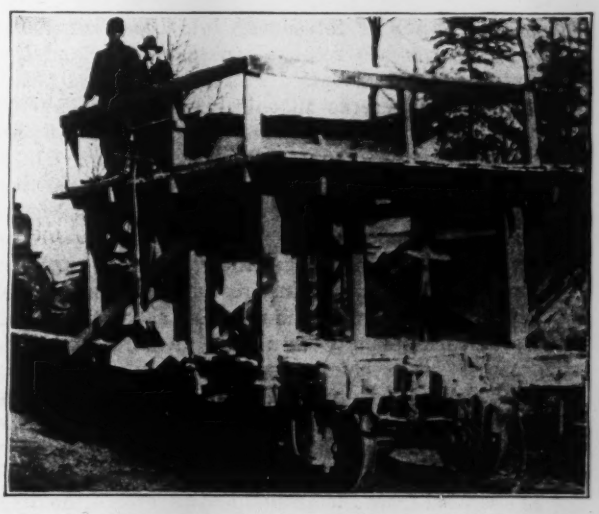
Concrete is mixed at two plants, alike in general details, one at each end of the bridge, and is distributed to near-by forms by chutes and to distant sections in distributing cars running on the adjoining railway bridge.

The south plant, situated at grade at the south end of the bridge, contains the usual mixer, sand and gravel storage, and other miscellaneous buildings. The sand and gravel, which is furnished by the railroads from their gravel pits, is run up in ballast cars on a timber trestle about 12 ft. high, where, by dropping the bottoms of the cars, it runs out within easy reach of each boom of a guy derrick, carrying a 1-yd. clam-shell bucket. Under this derrick, there is an area of about 8500 sq.ft., divided into three approximately equal spaces, one for the 2½-in. gravel, one for the 1-in. gravel, and the third for the sand. As fast as the cars are dumped, the derrick moves the material back from the trestle into large piles, so that it is possible to have on hand at one time sufficient aggregate for more than 1000 cu.yd. of concrete. When concreting is being done, this same derrick handles all the aggregate to the mixer, which is directly opposite the piles of material and just on the other side of the trestle.

As soon as the work at the south end of the bridge had progressed sufficiently, and when the cut and grading at the north end had been finished to allow it, a similar plant of the same capacity as that at the south end, except for storage, was placed at the north end of the bridge. This plant does not have the tower and chuting system, since in order to get it to a point where there is sufficient storage room it was necessary to place it about 200 ft. from the end of the bridge. This plant was built because when the concrete has to be poured anywhere in the north half of the bridge, or north of some point where it is necessary to be carrying on some other work from the old bridge, it can be mixed and handled from here without interfering with the other work going on the old bridge. At the same time the length of the haul is materially reduced.

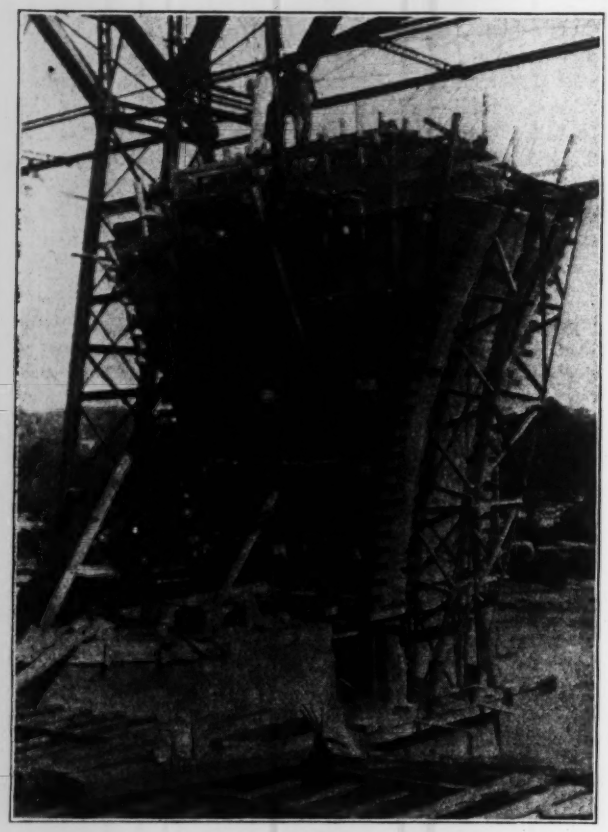
Aside from a local chuting system, which was used only so far as the two 60-ft. spans and the abutment pier at the south end of the bridge, there are two distinct methods of handling the concrete to the forms. Directly in front of the mixer is a 125-ft. timber tower carrying a 1-yd. bucket. The same engine which pulls the cement from the cement storage houses to the charging floor above the mixer pulls the concrete to the top of the tower, where chutes distribute it to the forms. About 30 ft. above the bottom of the tower is another hopper, from which the concrete is chuted into distributing cars, which run out over the old bridge and discharge the concrete wherever it is required.

One of the distributing cars is an ordinary timber underframe flat car upon which has been built a timber, steel-lined hopper large enough to carry three batches of concrete, the discharging gate from the hopper being placed just above the level of the car floor. It is hauled by a light broad-gage engine of the type which was originally used on the elevated railroads in New York City, a type which is peculiarly adapted to this sort of service because of its ability to accelerate quickly, attain a comparatively high speed, and stop quickly at the end of the haul. Out on the old bridge, wherever con-



LOW DISTRIBUTING CAR BROUGHT CONCRETE TO LOW-LEVEL WORK

crete is to be placed, is set another 2-yd. hopper at such a height that the concrete can be discharged into it directly from the distributing car, and from this hopper chutes are easily run down to the forms, by hanging them from the old bridge. The method is as follows:



PIER UMBRELLAS USED STEEL FORMS IN CURVES WITH WOOD LAGGING AND WOOD FORMS ON SIDES

While the distributing car is making its round trip out to the hopper on the side of the bridge, one batch of concrete is mixed, dumped into the bucket and hauled up to the top of the hopper on the side of the tower, and another batch is introduced into the mixer. By the time the car has returned to the mixer, and the first batch has been emptied into it, the second batch is sufficiently mixed, so that it is necessary only to lower the bucket, dump the mixer and raise the concrete about 30 ft. to give the car its second batch. By a stop watch, it is found to take about 40 sec. at the mixer, 30 sec. at the hopper on the bridge, and from a minute to a minute and a half for travel, depending on how far out on the bridge the car has to run. In other words, the mixer can mix as fast as the car can haul the concrete. In nine hours as many as 260 batches of concrete have been handled in this fashion, the greatest delays being caused by clearing trains.

The above order is followed where the haul is comparatively short. For the longer hauls, where the time consumed in traveling is necessarily longer, a gate is provided in the hopper on the side of the tower; this can be operated from the ground and permits of holding a batch of concrete in the hopper, one in the bucket in the tower, and a third in the mixer itself; so that the distributing car hauls three batches instead of two. Before the plant at the north end was put in operation, it was necessary to haul the concrete for the foundation of the north abutment and for Pier 2 the full length of the bridge. This was done three batches to a trip, and it was found that just as good time could be made in this way in spite of the length of the haul. As many as 33 batches an hour have been handled in this way, but this rate cannot be maintained throughout a full day, on account of such delays as are occasioned by the necessity for clearing trains.

The above method is suitable for that concrete which comes below a point at least 16 ft. below the top of the bridge. As the grades of the old and new bridges are the same, a special distributing car was built to take care of the concrete in the tops of the spandrel walls, the slab and the copings.

On a short flat car, similar to the one in the other distributing car, is built a wooden tower of 6 x 8-in. posts, braced with 2 x 10-in. planks, and fastened to the bed of the car by bolts passing through the sills of both the tower and the car. The tower is 5 ft. 9 in. wide, 10 ft. long, and rises 12½ ft. above the car floor, with a 3-yd. steel hopper so mounted on its top that the center of gravity of the hopper is approximately over the center of the track. In order to bring the center of gravity down as near the rails as possible, a bin which can hold 10 yd. of gravel, is suspended between the car sills and the rails, and reduces the danger from overturning.

At the center of the tower, and on the edge of the car nearest to the work, is mounted a 14-ft. boom, made up of two parallel 3 x 8-in. timbers, set 18 in. apart. This boom is pivoted at the bottom to allow its being swung either away from, or alongside the car, but is fixed at one vertical angle, by two ¾-in. steel rods at the top. Inside of this boom is a steel chute, 20 ft. long, pivoted under the hopper at one end, and with the other end hung from the boom by block and steel falls, so that it can be raised and lowered to any desired position by a hand windlass, attached to the lower end of the boom. The operator stands on a platform around the hopper to regulate the flow of the concrete.

The operation of this car is essentially the same as that of the lower car except that, instead of dumping

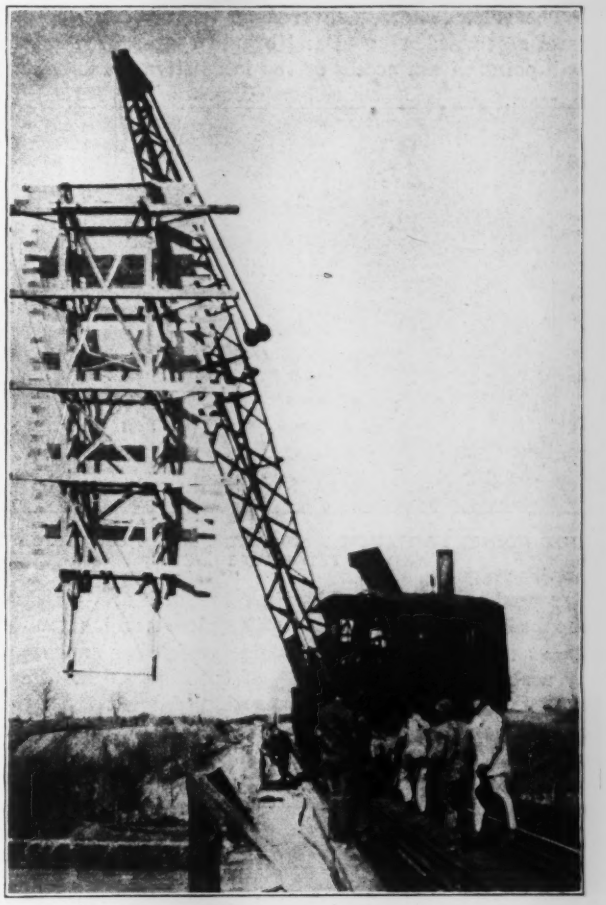
HIGH CAR WAS USED TO CARRY CONCRETE FOR UPPER PARTS OF BRIDGE

the concrete into the hoppers on the side of the bridge, the boom swings the end of the chute out over the forms and the concrete is poured directly from the car into the forms. While traveling, the boom and chute are swung alongside the car. The operation of this car is necessarily rather slow, but in view of the fact that all the time necessary to place hoppers and chutes is done away with, the actual time consumed in filling the forms is no greater than with the other method.

For forms for the sides of the piers, the Blaw collapsible steel forms have been provided, but wood forms are used in the ends. Inasmuch as the side forms are identical for the nine 14-ft. piers, and the four 20-ft. piers, it was decided to build the timber forms for the ends heavy and exceptionally strong, so that the same forms could be used throughout the entire bridge. The forms for the downstream end are made in two sections, and those for the upstream end in four. The sheathing is 1¼-in. dressed lumber, and the studs 6 x 8-in., all thoroughly spiked and braced. The forms are rigidly held in place with ¾-in. rods, incased in tin speaking tubes, and the wales are bolted to the steel forms, so that they may be moved with them to save handling. Instead of having the end forms braced together with rods, the wales are built with truss rods, and span the full width of the piers. Because of the size of the cross-section of the piers, it is impossible to pour them fast enough to get a sufficient head of soft concrete to cause these wales to bow. By so building these pier forms in units, it is possible to remove them in so few pieces, with only four men and a locomotive crane, that they can be taken off from one pier, and set up on the next, braced ready for concrete in four days. The 14-ft. piers can be poured in a little more than two days, and the 20-ft. piers in three days.

The forms for the so-called umbrellas, that is, the transition section between the pier and the arch, are also built partly of steel furnished by the Blaw Co., and partly of unit timber construction. The arch ribs being only 10 ft. wide, the curve of the intrados is taken care of by steel trusses, set 6 ft. c. to c., with the top chord bent to the proper radius. These trusses rest on timbers bolted to the pier proper about 5 ft. below the springing line. To these trusses are bolted 3 x 6-in. spiking strips to which the 4 x 6-in. lagging is spiked. To the bottom chord of these trusses are bolted permanently 4 x 8-in. wales, 18 ft. long, the ends of which are braced to the trusses with diagonal struts. Through the ends of these wales ¾-in. rods are passed to prevent the forms from spreading, and, being entirely outside of the concrete, they are removed without any difficulty when the forms are moved.

The curve of the intrados of the 122-ft. arches at the umbrellas is only slightly different from that of the 116-ft. arches, for which the forms were built. In order to accommodate the same forms to the 122-ft. arches, the ordinates between the two curves superimposed were computed every 4 ft., and blocks of these thicknesses were bolted between the trusses and the spiking strips. After the spiking strips had been placed around these blocks to make a smooth curve, additional blocks were placed between them, supporting the nailing strip every 2 ft., and preventing it from springing in under the pressure of the wet concrete.



UMBRELLA FORM WAS SLUNG FROM ADJOINING BRIDGE

As there is an abutment pier every third pier, the centering for the main arches is provided for by two complete sets of three ribs each of Blaw three-hinged steel arches, each rib being composed of two trusses, spaced 6 ft. c. to c., on which are bolted 3 x 10-in. spiking strips to which is spiked the 4 x 6-in. dressed lagging. These centers rest on steel brackets, carried in pockets let into the concrete of the umbrellas, about 4 ft. above the springing line. Across these brackets, and also under the shoes of the trusses, are oak timbers, 12 x 12 in. x 14 ft. long, separated by 8 in. of oak wedges. In the one case the timber is bolted to the bracket and in the other to the seats of the trusses, and, finally, to prevent overturning, they are bolted together. As a further precaution against overturning, the trusses are guyed to the umbrella and additional guys are run from the center hinge to the ends of the timbers bolted to the shoes of the trusses, these latter to prevent any tendency toward buckling of the centers.

The same steel centers are used for the 122-ft. arches and the 116-ft. arches by spreading them out at the bottom, and, at the same time, lowering them bodily 15 in., this being necessary to make them clear the outside point of the umbrellas. This naturally lowers the crown, but this condition was easily overcome by computing the ordinates between the top of the steel centers and the intrados of the arch, and building a false center above the steel center.

The steel centers, delivered at the site in sections, were assembled, riveted and braced complete in halves at a point within access of the locomotive crane, which

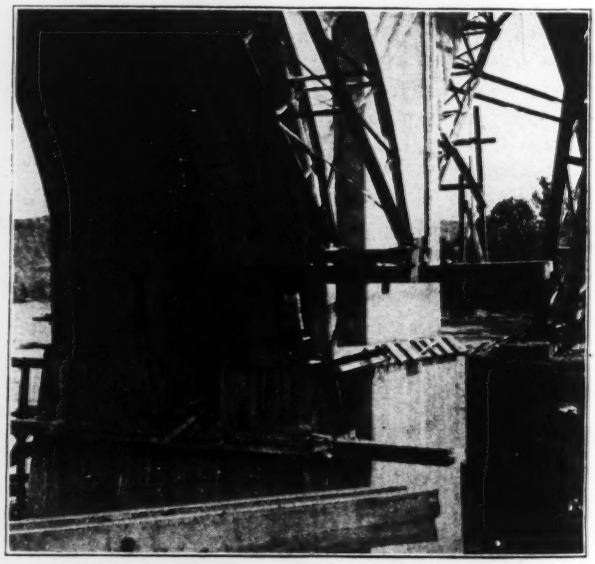
SIDE FORMS FOR ARCH RIBS WERE MADE ON GROUND AND LIFTED INTO PLACE

was used to set them. The timbers which are bolted to the brackets on the sides of the piers were extended under the old bridge, the outside end being supported by a steel cable from the top of the old bridge. Near the center of the span, and cantilevered out from the old bridge, are two beams of two 8 x 16-in. timbers each, carrying on their ends chain falls of sufficient capacity to carry half the weight of the center. The centers were lowered in two lifts to rollers on the bottom timber, the upper end being hung in the chain falls, after which the center hinge was connected by slacking the chain falls. They were then rolled over into their first position, the rollers removed, and the bottoms wedged up to the proper position, after which the spiking strips and lagging were placed. The process of removing them is merely the reverse of setting.

Side forms for the arch ribs are made on the ground and lifted into place. The ordinates between the extrados and the intrados were computed for every foot of the arch, and these curves were laid out on a rigid platform. Timbers, 2 x 6 in., were then bent around them and clamped to place, and a third 2 x 6-in. timber was laid straight between them. The 1¼-in. dressed lagging was spiked to them in this position in such a way that, when in place on the centers, it would stand vertically. In the case of the forms near the haunch, where the lagging was necessarily long, two and even three 2 x 6-in. timbers were used between the intrados and the extrados. These forms were then rigidly braced and were built in such lengths that all except those forms for the last section of the arch ribs next to the umbrellas could be used for both the 122-ft. and 116-ft. arches. The braces are set radially with the intrados, and are held in place at the bottom by a plank securely bolted to the lagging at frequent intervals, and at the top by rods passing entirely above the back forms of the arch. On account of the length of the braces at the haunches, it was necessary to run extra rods through the ribs, to keep the braces from distorting. The back forms are built in sections sufficiently long to reach from one spandrel to the next, so that they may be removed intact and used on all the arches. These forms can be built on the ground before being set much more cheaply than in place, and they are easily set or removed. There is a comparatively small waste of lumber, and there is great economy in using the forms over and over.

In pouring the arch ribs, a haunch section on all three arches is placed first; this is followed by, first, the sections immediately above the umbrellas and below the first spandrels; second, the intermediate sections between sections 1 and 2. Finally, the crown sections on all three arches are poured at once, transferring thrust to the piers uniformly.

When the concrete had set sufficiently for the arches to carry their own weight, the centers were struck, lowered bodily on rollers, and rolled laterally to their position under the upstream rib. It was originally planned to roll the centers from this position out to cars running on a temporary trestle just above the cutwaters of the piers and to roll them on these cars intact to the next set of arches. At no small expense, and with no little difficulty on account of the character of the river bed, about 600 ft. of such a trestle was built, and was used for the traveling derrick car in setting umbrella forms, etc. When the ice came down the river in January, this trestle was entirely destroyed, except that part on which the derrick car stood, next to the Southern R.R. track. It was, therefore, decided not to rebuild it, but instead to follow the reverse process of erecting the forms and to put the derrick car up on the old bridge where it could be used to much better advantage than in the river. It is now being used there,



EXTENDING TIMBERS CARRIED BASE OF STEEL-ARCH CENTERS FROM UNDER CONCRETE ARCH

together with an Industrial Works locomotive crane for handling chutes, forms, loose lumber and the like.

All the designs, plans and specifications for the bridge were prepared by J. E. Greiner & Co., consulting engineers, Baltimore, and the construction is under their supervision. The contractors are W. W. Boxley & Co., of Roanoke, Va.

Sees Serious Business Problems Ahead After War

Industry Must Be Put on International Basis and Huge Merchant Fleet Used, W. S. Kies Tells Publishers and Manufacturers

IT IS presumptuous for anyone to attempt to forecast the future, and it is, of course, unsatisfactory to speculate upon the effect of the war, and upon after-the-war developments, upon business, said W. S. Kies, vice-president of the American International Corporation, in the course of an address before the after-the-war-prepardness meeting of publishers and manufacturers held June 17 in Chicago. Business men, however, he continued, must of necessity look ahead, because it is impossible to run any business without planning for future growth and development. Business wants to be optimistic, and desires to proceed on the theory of continued growth and expansion. This is natural, but at a time like the present is dangerous, for there are many new factors which must enter into calculations for the future, and no far-reaching business plans are safe without taking them into consideration and discounting their possible effects.

The present and the future of American business is now in the hands of the administration at Washington. This is an established fact which, however, is not a proper subject for criticism, because this nation cannot be organized for war except through centralization of power and authority. The vitally important questions are—to what extent will these powers be exercised after the war; what will be the effect upon business organizations of the broad exercise of these powers during the war; and what new conditions created by their exercise will business have to meet in the future?

Results of War Price Fixing

Price fixing to-day is a war measure. It is an artificial interference with the economic laws of supply and demand. Its tendency, however, is to restrict production rather than increase it. Production in wartime is the all-important consideration, and is always stimulated by the possibility of profits. Excessive profits can always be taken care of by taxation. If, however, price fixing is successful in keeping down prices of necessities, and, at the same time, results in maintaining supplies sufficient for the nation's requirements, then we may well anticipate powerful support for a continuance of the practice after the war, even though the abnormal and artificial conditions which made for its success as a war measure shall no longer exist. Interference with fundamental economic laws always has in it the possibility of disaster. The laws of competition in the long run must determine prices, but the possibility of price fixing after the war, due to popular demand, is a factor with which business must reckon.

Profits to-day are limited as a result of price fixing and through excess profits taxes. When there is an overwhelming demand and the supply is inadequate, both price fixing and limitation of profits may be justified, on the theory that the hazard of finding markets for products and the business risk, due to possibility of over-production, is removed. In such a condition competition is no longer possible, and the producer has a monopoly with the power to make his own prices.

But after the war, when the problem of finding markets capable of absorbing our surplus production in this country will become serious, then price fixing and the limitation of profits will destroy business initiative and make commercial growth and expansion impossible. It is a plain fact, which the people and the politicians of this country must recognize, that the incentive to all business, the thing which makes possible the growth and expansion of a country, is the possibility of profits, and that any legislation which tends to restrict the earning possibilities and the reasonable profits of business is fatal not only to business itself, but to the continued development and the prosperity of the country.

May Have to Continue Control

To what extent, after the war, will the Government continue to restrict our exports and imports? To-day nothing can be imported into or exported from the country without a license. This power is exercised in the interest of economizing shipping space, of checking the production of non-essentials, and of restricting the consumption of non-essentials imported from other countries. When the war is ended tonnage will be plentiful and there will be no need for restricting the production or consumption of so-called luxuries, which, as a nation becomes more cultured and civilized, contribute largely to the pleasure and convenience of life. But a world condition may arise which will compel our Government still to continue a large measure of control over the foreign commerce of the country. The belligerent nations of Europe will need raw materials. They will need steel, machinery and other supplies for rehabilitation purposes. Their gold supply has been depleted and their credit exhausted. So huge are expenses and so large the accumulation of national debts that Europe may be forced to adopt bimetallism, if not obliged to go on a paper basis altogether. The purchasing power of the belligerents will necessarily be restricted, and we may reasonably look forward to not only a limitation of imports on the part of the European belligerents, but the purchase of necessities by the Government itself or through strong central organizations under Government patronage.

England, for example, might purchase its cotton through a Government agency, or through an organization of cotton manufacturers. France might purchase needed steel and machinery for rehabilitation purposes through a central agency. If such a development should take place, then, to protect our cotton growers and our manufacturers it might be necessary for our own Government to continue some form of governmental control over our exports and imports. Such a possible restricting of the free movement of our foreign commerce is a factor which will affect future business, because of the increasing importance of our foreign trade and the growing necessity of foreign markets to absorb our surplus production.

This country is to-day building ships at a rate which, if continued, will give us the largest merchant marine in

the world. In 1914 we built but 7.1% of the ships constructed in the world during that year. In 1918 it is estimated that we shall build in this country 48% of the world's tonnage, and in 1919 59% of the ships to be built in that year.

No matter how the war ends, at its close we shall be the second, if not the first, ship-owing nation in the world. Will we again permit our merchant marine to dwindle to insignificant proportions as we did once before in our history after the war of 1812?

Without Markets No Prosperity

The prosperity of every part of the country is closely dependent upon the prosperity of every other part, and the central West should be as vitally interested as the Eastern seaboard in the development of the means of carrying our foreign commerce. We manufacture and raise more than we can consume in normal times, and unless we can find and develop markets for our surplus products the country as a whole cannot be prosperous. In the upbuilding of this foreign commerce an efficiently operated merchant marine is a necessity.

Just before the war we placed upon our statute books a Seamen's Act which made it impossible for American ships, privately operated, to compete with the ships of other nations. For years our mercantile marine had been declining, and the Seamen's Act was the last blow.

A careful analysis of figures of cost of operation proves that before the war it was impossible to operate ships in competition with other nations which were not hampered by restrictive navigation laws. Even before the Seamen's Act was passed this differential in operating costs was sufficient to stop the increase of our marine. When the war opened there were under the American flag a mere handful of ships. The necessities of war demanded ocean transportation, and to meet the situation billions of dollars were placed at the disposal of the Shipping Board for the purpose of constructing and operating ships. The lack of tonnage, the tremendous demand, and high freight rates make it possible to operate now without consideration of operating costs. After the war this will be different. That the great merchant navy we are now acquiring will be operated goes without saying, but it is for the American people to decide the serious question of policy as to whether it shall be operated under private management, and have the benefit of private initiative, or whether it shall be operated by the Government.

If it is to be operated privately, restrictive legislation must be supplanted by constructive measures in aid of its maintenance. To compete with the rest of the world in ship operation, the conditions under which we operate must be equalized. If it costs more to build and operate ships in this country, and we expect to maintain our marine, then the difference in cost must be made up in some way. If the Government operates, this difference will be met by drafts upon the public treasury, as in the case of the Post Office. But do the people of the United States desire Governmental operation of our merchant marine? Are they sufficiently confident that such management will prove efficient and economical?

At the moment Government management may be successful, because in wartimes political favoritism is admittedly unpatriotic, and the great danger of politics and the building of a political machine through Government operation is less threatening. The best brains and highest managerial skill are at the command of the Government. Men to whom private corporations would readily pay thousands of dollars for the use of their ability are to-day in the service of the Government without compensation, actuated by patriotism and a desire to serve in this crisis. When the war is ended the Government can no longer retain these men, and without them successful operation is impossible.

The future of our merchant marine is in the hands of the people; the policy to be adopted after the war is of serious consequence to this nation and should receive the careful, thoughtful consideration of every citizen.

The railroads of the United States were taken over by the Government, as a war measure, last December. It was rightly assumed that the wartime needs of the country in transportation could only be taken care of by the proper coördination of all the railroad lines of the country and their operation as one unified system, but the railroads were so shackled by state and national restrictions that this coördination under private management—however desirable—seemed impossible of achievement.

If unified operation results in economies, improvement in service along some lines and a profit to the Government, then immediately a strong campaign will be inaugurated to have the Government permanently retain control of the railroads, and the result of this campaign will be a factor of great importance in the future business development of the country. When the world crisis has passed the patriotic incentive will no longer exist. The best men in the railroad world will seek employment elsewhere because of restricted opportunities in the Government service. It is inevitable that the railroad labor unions will obtain larger and larger control of the railroads of the country, and that politics will dictate the appointment of high officials, the rate of wages, and the policy of extensions and service in different communities. The vast political machine which could be built up out of the railroad employees of the country, reinforced by the sailors of our merchant navy if this too were Governmentally operated, would be in complete control of the country.

What of Demobilization?

When the war is won, what of the problem of demobilization of our armies and of the reorganization of industry for the purpose of again taking up the pursuits of peace? Let me point out a few of the serious questions that will arise. The millions of men who have been fighting our battles will of right be entitled to their old places in commerce and industry. Will the women workers, who have tasted the fruits of economic independence and have earned large wages, willingly give up their places?

The workers of this country are now receiving wages unheard of before in history. When the men released from war come into the labor market and the law of supply and demand begins to operate, will wages be reduced to a lower level in an orderly manner or shall we enter upon a period of labor troubles with attendant strikes and riots?

Our soldiers have been fighting the battles of democ-

racy. The world is imbued with this idea, and the ideals of democracy, as put forth not only in Russia but in conservative England, contemplate the control of industry by labor. The movement in labor circles looking toward industrial democracy is deserving of most careful and sympathetic study by all employers, for it expresses a fundamental and powerful instinct of human nature which must be reckoned with. There is no getting away from the fact that we must face an adjustment between capital and labor after the war, and that, unless this situation is handled with the utmost intelligence and wisdom on the part of both the leaders of capital and labor, serious consequences will result.

If it be possible to turn the forces of production from war materials into peace-time production, and to find markets for all that we can produce, so as to keep our industrial machine going at top speed, then the problem will be less aggravated. But here again we must clearly face certain facts. The productive capacity of the country has increased during the last three and a half years. Large additions to our great industrial plants have been built. The output of this increased capacity must be sold in order to keep these plants going.

Little Opportunity in Europe

After the war the purchasing power of Europe will be decreased. The belligerent nations have piled up huge debts. England's debt has increased from $3,458,000,000 to $27,636,000,000; France from $6,598,000,000 to $22,227,000,000; Italy from $2,792,000,000 to $6,676,000,000, and Germany from $1,165,000,000 to $25,408,000,000. The gold resources of Europe have been depleted. With national debts reaching staggering totals there will be difficulty in finding funds or arranging credits to pay for imports. In fact, the problem of the European belligerents will be to build up depleted gold reserves and shattered credits, and this can only be done by restricting the consumption of imported articles and by stimulating exports. Except, then, for raw materials absolutely needed to feed her industries, and machinery and construction materials needed for rehabilitation, European markets will offer little opportunity. The surplus products of this country must, therefore, find their markets in neutral countries that have not been impoverished by war. But in these neutral markets we shall meet a keener competition than before the war because of Europe's necessity of rebuilding its financial strength through favorable export balances.

Of course Europe's problem of demobilization will be even more exaggerated than ours, because of the more perfect organizations for war purposes, but Europe, particularly England and France, have learned lessons in industry as a result of the war which will make their competition in neutral markets more keen. The United States and Germany, before the war, were the exponents of mass production. We know that England and France have shown marvelous development along these lines during the war, and it is safe to assume that after the war the same methods which have so wonderfully increased the munitions production of England and France will be used in the production of articles for international commerce, and by these methods they will be produced at a cost as low or lower than we can produce them here.

Competition in the world's markets is mainly on the basis of price. If the quality is practically the same the cheaper article will dominate a market. The cost of an article in commerce is mainly made up of the cost of capital, the cost of raw material, and the cost of labor. Improved scientific processes, skillful direction and intelligent labor may tend to decrease the cost, but the cost of labor is so large a part in the cost of most articles that, if it is out of line with labor in a competing country, the product suffers in competition in foreign markets. It seems inevitable, therefore, that if industry is to be kept prosperous in this country our foreign commerce must be maintained, and to do this production must be continued on a basis that will enable us to compete. This may of necessity mean lower wages as a last resort, but every other effort to bring down the cost of production should first be made. Labor must be taught that its interests lie in intelligently aiding in increasing the results of its labor, which would help to bring down unit costs. Labor, on the other hand, has the right to demand the most skillful and intelligent management. Organization of our industries along the lines of cutting down useless expenses, eliminating wasteful competition and combining for the purpose of the purchase of raw materials, the marketing of goods, and the extension of credits will put our industries in a stronger position to compete against the world.

Foreign business after the war, in spite of the many difficulties, holds promise of large volume. The neutral countries of the world have been shut off from their European sources of supply, and the shelves are empty. Needed improvements and developments, both public and private, have been postponed until after the war. Many of the neutral countries prospered as we did and are in a position to buy for cash or on short credits when shipments are possible. On the other hand, the undeveloped countries of the world have been obliged, for lack of capital, to pause in their development.

We Must Extend Credit

Europe must have credits for raw materials, and for the machinery and construction materials needed for rehabilitation. This means that we must develop in this country a market for foreign securities. We are much better equipped to extend credit and to take advantage of foreign business possibilities than we were before the war. The wealth of our country has increased, and we have sources of credit information which did not previously exist. Branches of our national banks have been established throughout the world.

Our banking system, under the Federal Reserve Act, is elastic, and furnishes the machinery for enabling this country to take its part in world finance. The Federal Reserve Act permitted national banks to accept bills of exchange drawn against merchandise, first in foreign trade, and latterly extended to domestic trade. This gives us the opportunity of developing a great, broad money market in this country, built around the handling of acceptances, which are the most liquid and most desirable of the forms of commercial paper.

One other favorable factor which we must not overlook, and which gives cause for confidence in the future in spite of the many serious problems to be faced, is

the great addition to the sum of knowledge of world business which we have obtained, and the shaking off of our provincialism in the development of a broader international viewpoint. We know more about the peoples of the world, their characteristics and their national ideals than we did before the war. We have sensed our international obligations and have developed a feeling of world citizenship. Our country stands before the world as an unselfish exponent of the highest ideals of democracy, and as an example of national sacrifice to our sense of right and duty to the world. The magnificent work of our Red Cross has created respect for our ability to do things, and has inspired a feeling of gratitude and affection for the American people. In the years to come prejudices which affected our business relations in other countries will be removed, and it is safe to say that our relations, both commercial and public, with the nations of the world will be on a much more friendly basis of understanding in the future than in the past.

Proposed Constitution for Standards Committee

Would Have Government Departments Participate in Work of Setting Up Engineering Standards—Report Submitted

SECTIONAL committees are to develop and recommend standards to be passed upon by the main American Engineering Standards Committee, which is to meet four times a year and to be composed of representatives of the four national engineering societies, the American Society for Testing Materials, and three Government departments, according to the provisions of the constitution submitted by a committee appointed to take up the question on behalf of the societies mentioned. This committee reported to the American Society for Testing Materials at the recent Atlantic City annual meeting, reported on p. 56 of this journal last week. The salient provisions of the proposed constitution follow:

The object of this committee is to unify and simplify the methods of arriving at engineering standards.

The Main Committee shall be composed of three representatives each from the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Society for Testing Materials, and three each from the Department of Commerce, the War Department, and the Navy Department.

The Main Committee shall elect annually a chairman and vice-chairman from its own membership. The Main Committee shall elect from its own members an executive committee consisting of one representative of each society and Government department.

The executive committee shall engage a secretary, who shall not be a member of the committee. The Main Committee shall hold at least four regular meetings each year on dates to be specified by the committee. The chief duties of the Main Committee shall be to receive and pass upon recommendations for standards approved by sectional committees; to formulate rules under which the sectional committees shall be constituted and organized and to maintain a central office in the Engineering Societies Building in New York with a paid full-time secretary, which office shall also serve as a bureau of information.

Any proposed standard submitted to, and approved by, the Main Committee shall be known either as a "recommended practice" or as a "tentative standard," and when, in the opinion of this committee, after approval by the sponsor society or societies, it has proved its suitability, it shall be known as an "American standard." The approval as "recommended practice" or as "tentative standards" of any standard submitted to the main committee shall require the affirmative vote of three-fourths of the committee; the advance of status to "American standard" shall require an affirmative vote of 90 per cent of the Main Committee. Such votes shall be by letter ballot. A "recommended practice" or "tentative standard" may be revised at intervals of not less than one year, by the same procedure as that required for its original approval. A period of not less than one year shall intervene between the last revision and the admission to "American standard." An "American standard" may be revised at intervals of not less than three years by the same procedure as required for its original approval.

Any society coöperating in the preparation of standards shall notify the Main Committee of the names and affiliations of the members of, and the field covered by, any existing or proposed committee dealing with a standard of any kind. It shall also send to the Main Committee not less than 20 copies of each standard which it has in force. Any proposal for the development or adoption of a particular standard or group of standards shall be referred to the Main Committee, which shall request one or more of the societies coöperating to organize a sectional committee to carry on the work. The society or societies so designated shall be sponsor (or joint sponsor) for the work in hand, and the final recommendations of the sectional committee shall be made to the sponsor, who shall submit these recommendations to the Main Committee. The Main Committee shall not approve these recommendations without the previous approval of the sponsor.

Sectional committees dealing with standards of a commercial character (specifications, shop practices, etc.) shall be made up of representatives of producers, consumers and general interests (engineers), no one of these interests to form a majority.

Sectional committees dealing with standards of a scientific or noncommercial character shall consist of persons specially qualified, without regard to their affiliations.

"Recommended practices," "tentative standards" and "American standards" approved by the Main Committee may be printed in the publications of any coöperating society under the appropriate title and over the statement "Approved by the American Engineering Standards Committee." They shall not be released prior to such publication, whereupon right to publish may be granted to any other publisher.

Hog Island's Ship-Erection Equipment: Four Hundred Tower Derricks for Fifty Ways

With Larger Program Than Other Yards, and Building Ships of Two Sizes, American International Provided Ample Equipment—Trucking Road in Addition to Track at Each Way

SHIPBUILDING at the great Hog Island yard is carried on with quite different erection equipment from that of the other agency yards. It is steel-erection equipment, however, and not shipbuilding equipment, and in this respect most of the yards at which Emergency Fleet Corporation work is being done embody the same idea. That established shipyard precedents were not followed is most noteworthy in the case of Hog Island, for the American International Shipbuilding Corporation is affiliated with one of the largest of the older shipyards—that of the New York Shipbuilding Corporation at Camden, opposite Philadelphia. Overhead traveling cranes have given very satisfactory service at Camden, but in spite of this Hog Island adopted derricks. Derricks could be obtained quickly and in large numbers, while cranes of other types would have had to be built as special orders, requiring a long delivery time.

Fixed towers carrying stiffleg derricks, set between the shipways, were chosen as the erection tools (Fig. 4), just as at the Newark Bay shipyard of the Submarine Boat Corporation. In all other points, however, the two yards differ widely in their erection equipment. Thus, the Newark Bay yard, as was described in *Engineering News-Record* of June 6, 1918, p. 1073, has its shipways grouped in pairs, hull material is stored at the head of the ways, and erection is handled by derricks on towers between the pairs which hoist from a railway track in the middle of the pair. Further, the derricks being set on the middle line of the towers, one at each end, the arrangement is strictly symmetrical. In all these points the larger yard is different. At Hog Island, structural hull material is stored in a single central storage yard of highly systematized arrangement, and other material is stored in storehouses, located on the main roads of the plant. The supply to the shipways is over a railway track along one side of each way and a plank road (for trucking) along the other side. The road, a feature peculiar to Hog Island, makes the layout unsymmetrical. The keel blocks are placed 1 ft. off the center line of the way, to give extra clearance at the railway track, not required at the road on the other side. The derrick towers are placed astride of the road, and thus are nearer one than the other of the two adjoining ships; to make up for this the derricks are set unsymmetrically on the towers. The section, Fig. 1, shows the points mentioned. Further information is given by the plan, Fig. 2, which explains the arrangement of the ways with respect to each other and to the supply tracks and derrick towers. A detail characteristic is the use of wooden derricks at Hog Island, as the view, Fig. 7, exhibits, as against steel derricks at most of the other large yards.

But the most prominent feature of Hog Island's erection equipment is the great number of derricks provided. There are in all 400 tower derricks for the 50 shipways, or eight booms per ship over the ways, besides a derrick on the ground near the head of each way. This represents a considerable safety margin over the max-

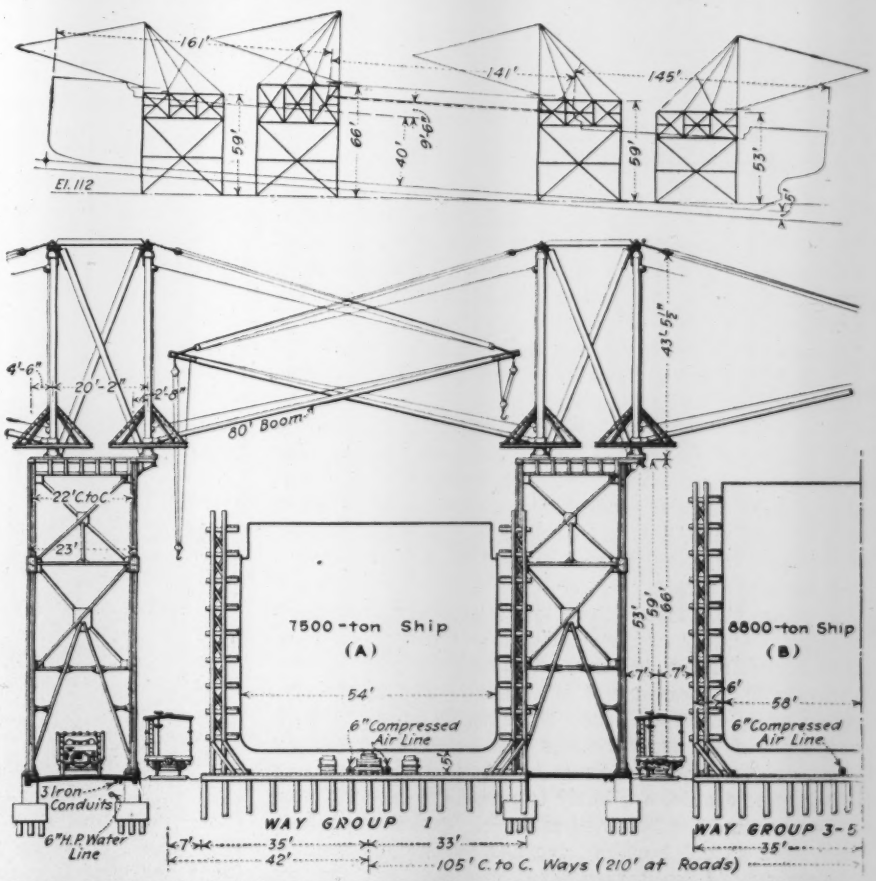


FIG. 1. RELATION OF SHIPWAYS, ERECTION DERRICKS, TRACKS AND ROADWAYS

Road and track in lane between ships; ship off center of ways; derricks not symmetrical placed on towers; scaffolding on shipway platform. Two types of way, built for "A" and "B" ships, are shown side by side, but occur only in separate groups of ten. The ways for "B" ships are longer and have closer pile spacing. "A" ships may be built on either type of way

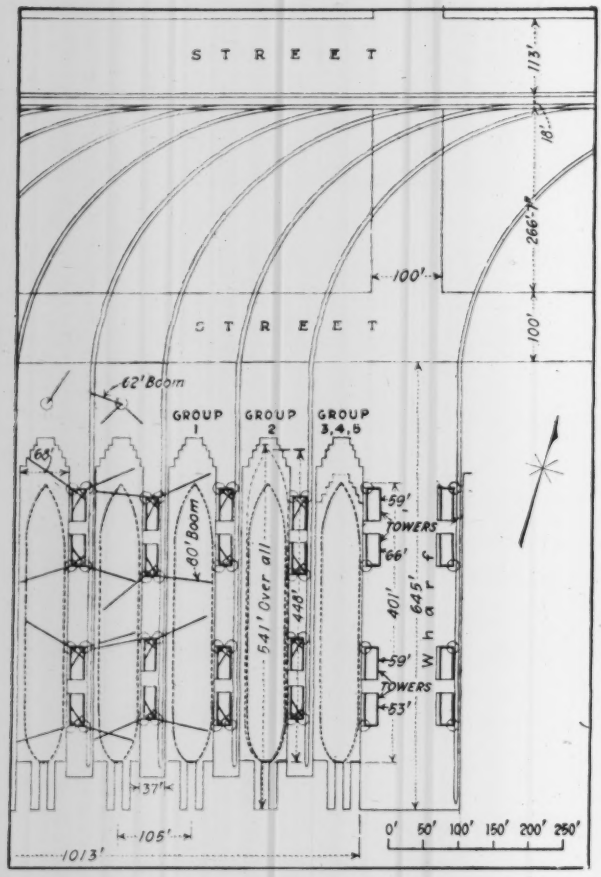


FIG. 2. EIGHT DERRICKS IN EACH LANE BETWEEN SHIPS

imum estimated service requirements, as well as a hope that at some stages of the twenty-three month contract period—during which 180 ships must be built, with total dead-weight carrying capacity 1,441,000 tons—unexpectedly high speed of erection could be obtained if a surplus of hoisting equipment were provided.

Hog Island is the largest of the agency shipyards, having nearly twice as many ways (50) as the Submarine yard at Newark Bay (28). This in itself gave the American International Shipbuilding Corporation a different problem with respect to the shipbuilding tools. The adopted machines are the simplest, most easily replaceable hoisting devices in the country—five-ton wooden derricks, framed on the ground with standard derrick fittings.

For its enormous shipbuilding program, the yard draws its supply of fabricated ship parts from more than fifty different structural steel shops, scattered from Virginia to Nebraska and Minnesota. The ample provision of erection derricks—other yards have only two hooks per ship, against eight here—and the resulting ability to concentrate excess hoisting capacity on any one part of a ship, are likely to prove valuable features if at any time the inflow of material from the fabricating shops should become irregular beyond the equalizing capacity of the storage yard.

A graphical showing of the flexibility of derrick service which features the Hog Island layout is given by the plan sketch, Fig. 3. This shows the several derrick circles and their overlap in various degree. No part of the ship is served by less than two hooks, while parts of the area are served by three and four. Interruptions of service may be considered wholly eliminated, with this arrangement. A slight limitation on flexibility lies in the fact that in some few positions the two derricks on one tower cannot handle their rated loads simultaneously.

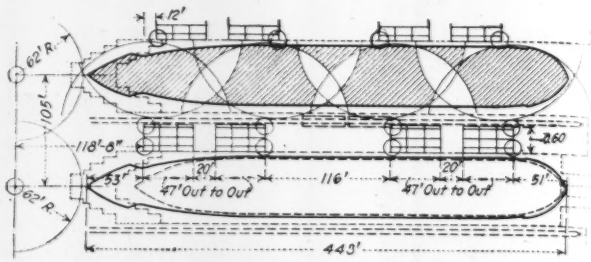


FIG. 3. TWO TO FOUR HOOKS AVAILABLE AT EVERY POINT OF SHIP BEING BUILT

Hatched areas are covered by two hooks. The white segments are covered partly by three and partly by four hooks.

That the selection of the machinery was governed more by availability than by any other consideration has already been mentioned. Before derricks were chosen consideration was given to cableways—one cableway longitudinally over each ship—because of their simplicity, their success in Pacific Coast shipyards, and their use in a few prominent cases elsewhere. These grounds were not believed to be adequate, however, in relation

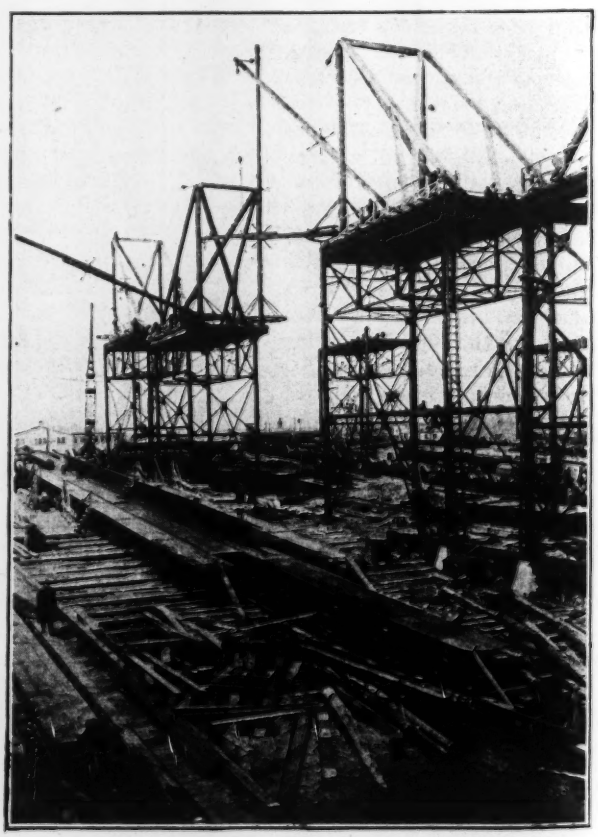


FIG. 4. FIXED STEEL TOWERS, EACH CARRYING TWO WOODEN DERRICKS AT SAME END

to the high-speed erection contemplated. Detail study indicated that the use of cableways would involve considerable loss of space and that the operating characteristics did not give promise of being best suited to the service. Cableways were therefore rejected. Once derricks were decided upon, the selection of capacity had to take account of possible assembly of ship sections on the ground (at the head of the ways) before they were placed in the ship. The parts as received from the shops are below two tons in weight. Bulkheads might be assembled in horizontal position, to advantage, but as they weigh up to 30 tons some limit had to be set to this procedure in advance. Small derricks were believed to give such a gain in operating speed that it was finally concluded to disregard bulkhead assembly and limit the capacity to five tons.

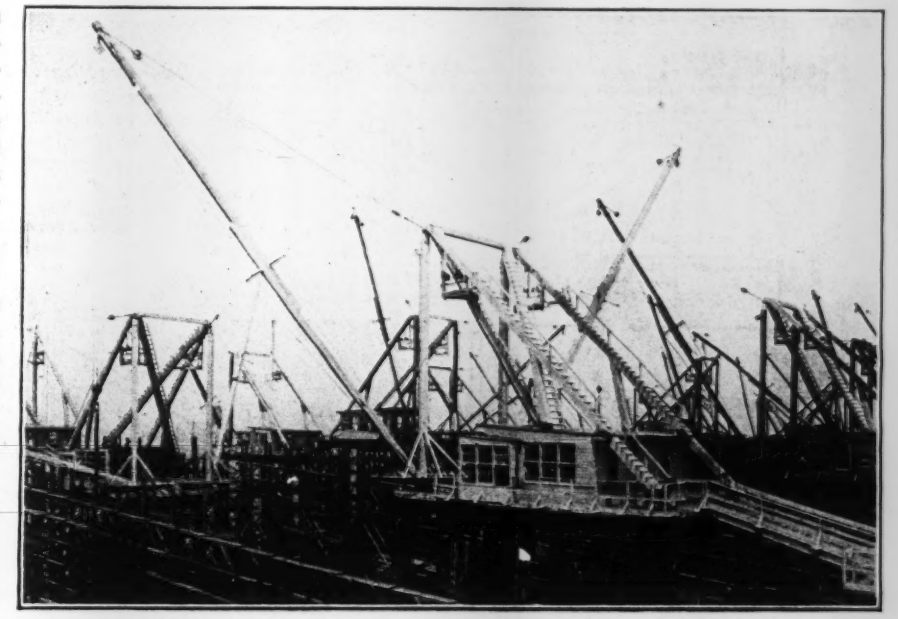


FIG. 5. EACH STEEL TOWER CARRIES AT ONE END TWO WOODEN DERRICKS WITH UNUSUAL STIFFLEG ARRANGEMENT

Data concerning the dimensions and locations of the towers and the relation of their height to the ship's height will be found in the sectional diagram Fig. 1. The towers range from 53 to 59 ft. high, the lowest being at the outshore end, while the highest is alongside the bridge. The design in all respects is for the larger of the two types of ship which the American International Shipbuilding Corporation has on order for the Government (dead-weight tonnage 8800, length over all 450 ft.) The dimensions of the two were given in *Engineering News-Record* of July 4, p. 6.

Various interesting features of the derricks and towers are brought out by the drawing, Fig. 5. With both derricks at one end of the tower the bull wheels are too close together to admit bracing in the plane of the two masts, and in consequence diagonal stifflegs were necessary. As the two stifflegs have to pass each other, they are set at different angles; the deck plan of the derrick tower shows this most clearly. Steel brackets forming part of the tower construction engage pins in the lower ends of the stifflegs, taking the uplift when the load is far out and also holding the derricks in position on the platform.

The towers have rigid bracing throughout. The end planes have A-frame portals, which give the necessary traffic clearance over the trucking road. The side bracing contains trusses to support the load of the deck.

The derricks were among the very first items of equipment ordered by the corporation. At the time, the controlling view was that all the plant construction should be of most temporary character—to do the required work at lowest first cost. Accordingly the towers as well as the derricks were to be built of timber. Difficulties in developing satisfactory tower framing with timber were soon encountered, however, and the design was worked out in steel. Timber derricks were retained, and the result is the present combination of wood and steel. Alternating-current motors operate the hoisting engines. They are induction motors with resistance control through slip rings. The yard transformer station receives current by high-voltage transmission from Philadelphia, and steps it down to 440

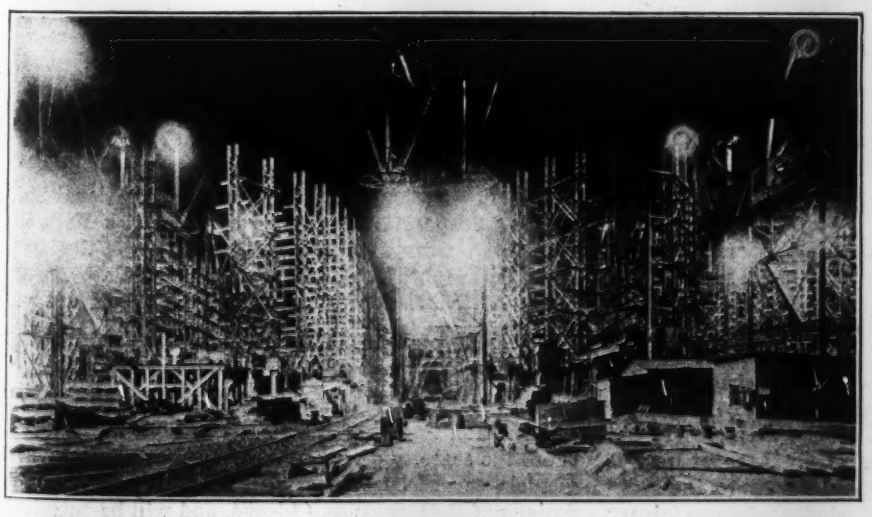


FIG. 6. SCAFFOLDING AND DERRICKS ARE FITTED WITH PROJECTOR LAMPS FOR NIGHT WORK AT HOG ISLAND SHIPYARD

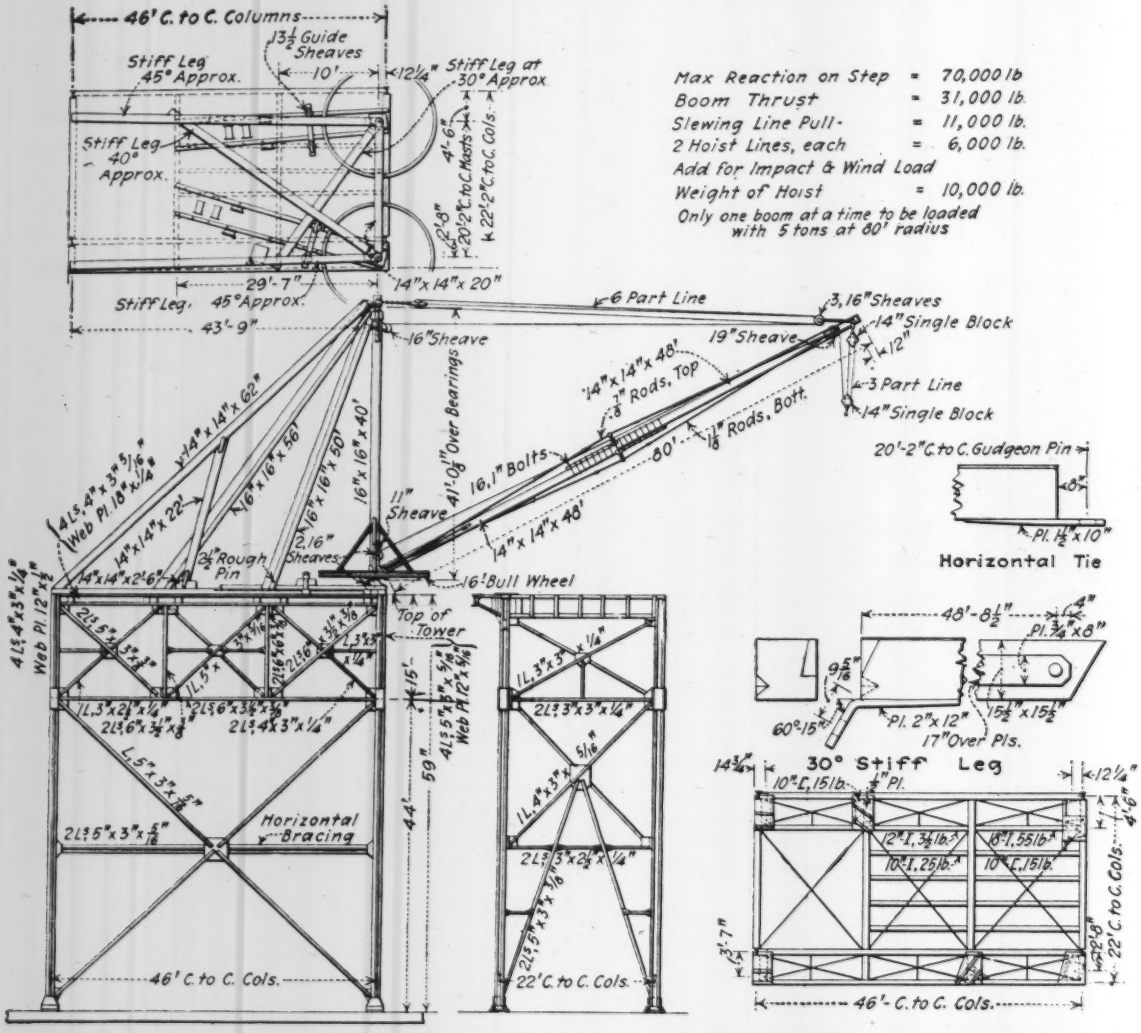


FIG. 7. FIVE-TON DERRICKS AT HOG ISLAND BUILT UP WITH STANDARD IRONS

volts for the motor circuits. Underground duct lines lead to the derrick towers.

The American Hoist & Derrick Co., of St. Paul, designed the derricks and furnished the derrick irons and the hoisting engines. The towers were designed by the Works Department of the American International Shipbuilding Corporation and were built by three different concerns, John Eichleay Co., Blaw-Knox Co., and American Bridge Co., all of Pittsburgh. The towers were erected and the derricks were framed by the shipyard forces.

The provision of trucking roads in the lanes between shipways is an extension of the close-mesh road system of the yard to the ways (note the approach road in Fig. 6). All hull material reaches Hog Island by rail, and the intention is to schedule its fabrication in such order that it can go direct to the ways when received. If it must go to the general storage yard, it is later again loaded on cars and sent to the ways; there are no vehicle roads in the storage yard. A great deal of ship equipment material, however, comes to the shipways from storehouses; this includes piping, joinery and a multitude of other items, required at all stages from the assembly of the double bottom up to the time of launching. This material will be brought to the ship by road.

A secondary purpose of the spur roads is fire-protection. The yard fire department is able to go down the road between ways as readily as along the main thoroughfares and thus commands every part of the building-berth area. All roads in the Hog Island shipyard are built with plank surfacing.

The organization of the American International Shipbuilding Corporation is headed by Frederick Holbrook, president. George J. Baldwin is chairman of the board. Peter O. Knight, H. D. H. Connick, A. R. Patterson, F. W. Wood, H. L. Rogers and G. O. Muhlfeld are vice presidents.

Concrete Freight Cars May Be Coming

The use of concrete as a substitute for steel in car construction is one of the latest methods suggested to offset the scarcity of steel. A 40-ft. reinforced-concrete gondola car of 50 tons capacity is being built to the designs of J. B. Strauss, Chicago, and will be submitted to loading and service tests.

Arched Steel Cantilevers Used in Park Avenue Viaduct

Crossing Over Forty-Second Street, New York, Creates New Thoroughfare to North—Spans Arched for Beauty—Design Eliminates Thrust

By Harry W. Levy
Assistant Engineer in Charge of Designing, Bureau of Highways, New York City

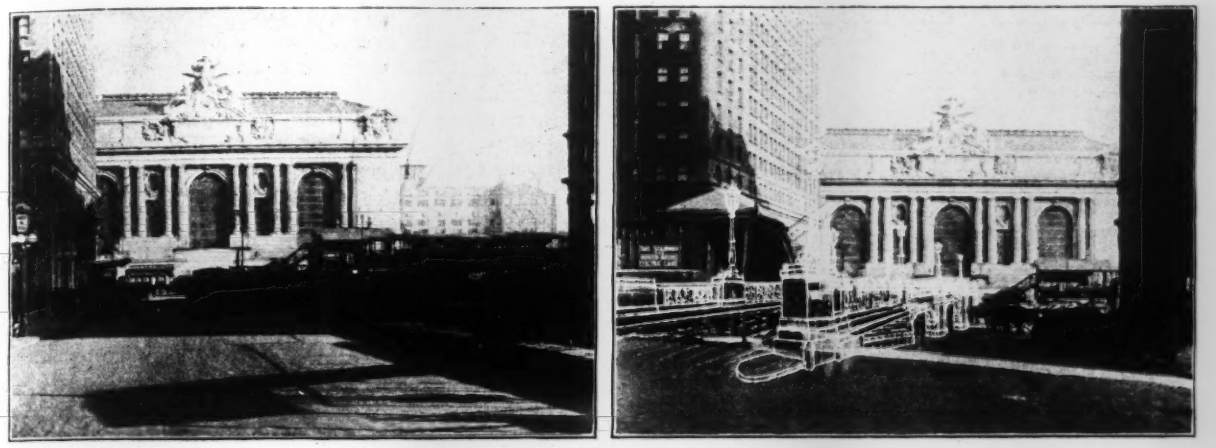


FIG. 1. VIADUCT AT GRAND CENTRAL TERMINAL WILL CARRY NORTH-SOUTH TRAFFIC OF PARK AVENUE OVER FORTY-SECOND STREET TO ELEVATED ROADWAY AROUND TERMINAL BUILDING

STREET traffic north and south at the Grand Central Terminal in New York City is seriously hampered by the narrow streets, street-car concentration, traffic congestion and the detour around the station building. An important improvement will be effected by a new viaduct, now under construction, carrying Park Ave. across 42nd St. over grade, and leading to an elevated roadway which, passing around the west side of the station building, connects by way of 45th St. with the northward prolongation of Park Ave. In designing this structure, conditions led to the unusual expedient of using steel cantilever girders shaped to appear as arches. Æsthetic considerations called for arches, but as the site is over a network of rapid-transit subway structures it was not practicable to provide abutments for true arches. The arched cantilever construction offered a convenient solution.

In the Borough of Manhattan the heaviest traffic is carried by the north and south thoroughfares, which are few in number, being spaced about 800 ft. apart. Some

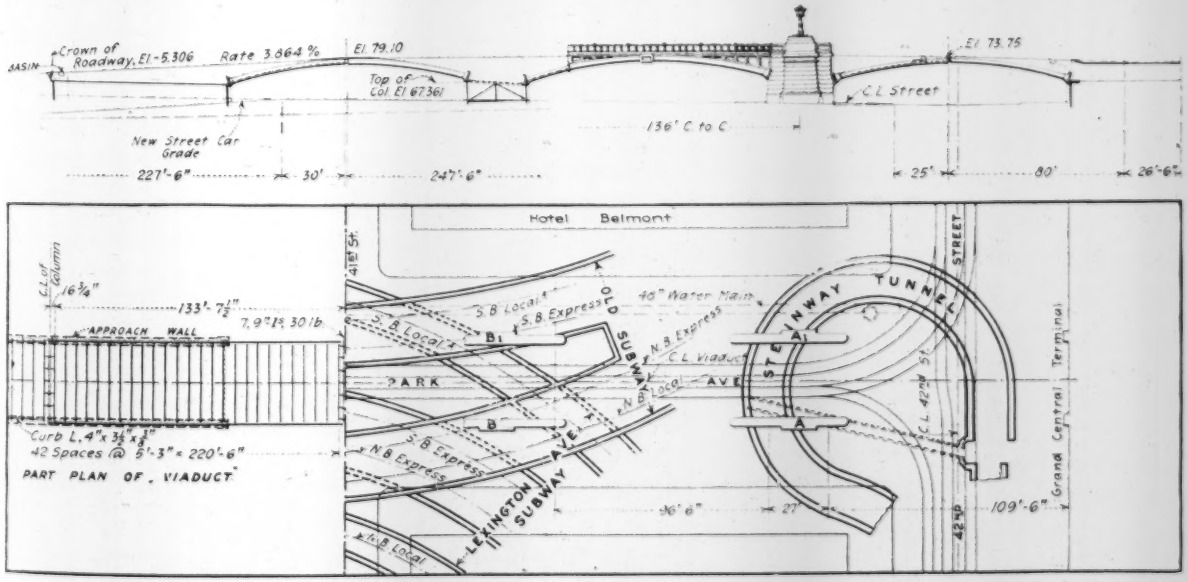


FIG. 2. VIADUCT SUPPORT OVER COMPLEX NETWORK OF RAPID-TRANSIT SUBWAYS WHERE NEW LEXINGTON AVENUE LINE CONNECTS WITH FOURTH AVENUE LINE

of them, like Park Ave., are not continuous, and steps are being taken to relieve this situation by connecting the parts now obstructed. The most important advance in this respect will be made by the completion of the Park Ave. viaduct.

Park Ave., or Fourth Ave., is now interrupted from

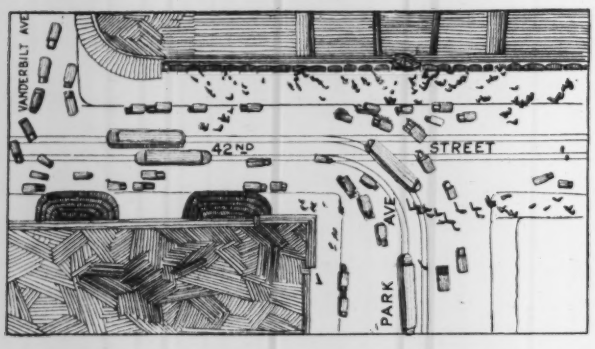


FIG. 3. TRAFFIC CONCENTRATION WHICH VIADUCT WILL RELIEVE—SKETCHED FROM AERIAL PHOTOGRAPH

42nd to 45th St. by the Grand Central Terminal building. Vehicles must take a roundabout route through 42nd St. and Vanderbilt Ave. When the Grand Central Terminal was designed, in 1911, provision was made for the railroad company to continue Park Ave. southward from 50th St. to 45th St. by way of a steel viaduct over the railroad tracks, and construct an elevated roadway around the western side of the Terminal building to 42nd St. The city agreed that it would build a viaduct south of 42nd St., connecting the elevated roadway with Park Ave. at 40th Street.

The railroad work was completed some time ago, but the building of the viaduct by the city was delayed, owing to the construction of the new Lexington Ave. subway directly beneath the proposed footings of the viaduct. The subway is now nearing completing. The contract for the viaduct has been awarded and work has been begun; if there is no unexpected trouble in obtaining deliveries of steel, it will be completed early in 1919.

The structure is directly over the present street railway tracks, which here are in the open-cut approach of the street-railway tunnel extending from 34th to 40th St. They are at present several feet below the street grade, but are being raised in connection with the construction of the viaduct to meet the roadway grade of Park Ave. between 41st and 42nd Sts. This will open 41st St. to crosstown traffic.

Because of its location, the new structure was subject to rather high æsthetic requirements. It was designed to harmonize architecturally with the Grand Central Terminal. The graceful lines of the viaduct, its paneled steel arches and its ornamental lamp standards and railings give it a monumental character.

From 40th to 41st St. there will be an approach carried by closed granite-faced walls. Three arch-shaped spans extending north from 41st St. will connect it with the elevated roadway at the front of the Terminal building. These spans, while in appearance steel rib arches, are heavy steel cantilever girders resting on pairs of columns in the approach walls and piers. The granite piers are ornamental only, the entire load from the viaduct being carried by the steel columns.

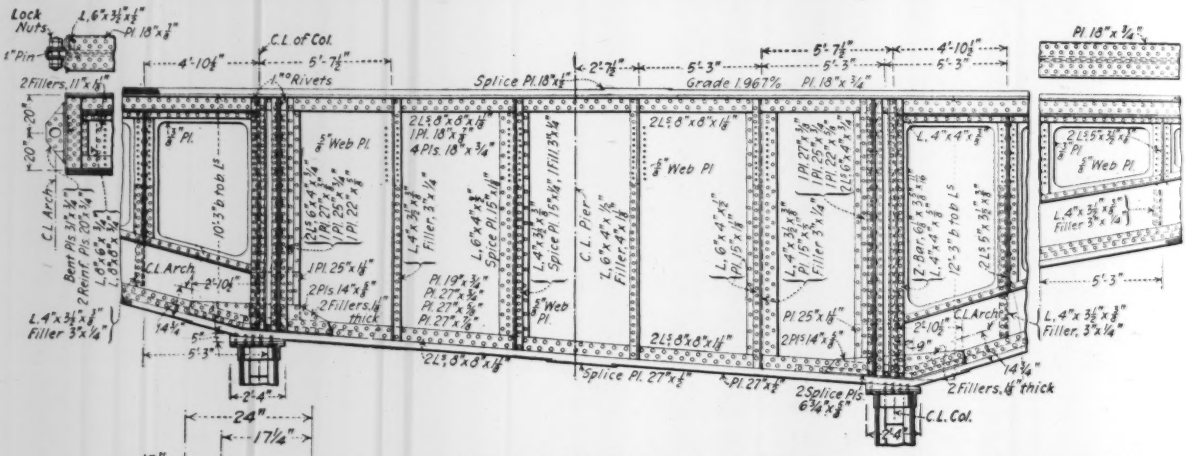
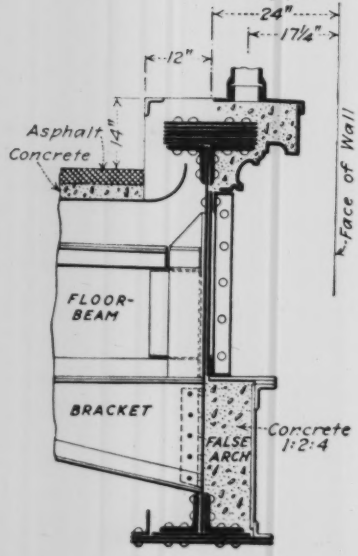


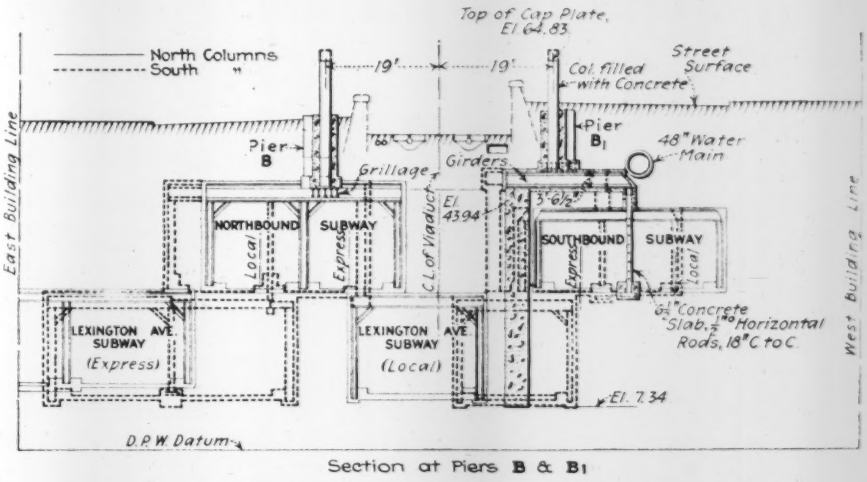
FIG. 4. FRAMEWORK OF "ARCHES" CONSISTS OF STEEL CANTILEVER GIRDERS CARRIED ON COLUMNS IN PIERS—PANELING OF GIRDERS SURMOUNTS FACING RIB

The girders will be built up to appear as steel box paneling resting on a long steel arch chord member abutting against the granite piers and approach walls. Above the steel paneling an ornamental iron fascia supports a decorative railing. The cross-section in Fig. 4 shows the facing-rib construction used to emphasize the arch appearance, and also shows the coping fascia.

The viaduct is designed for a distributed live load of 100 lb. per square foot., in addition to a concentrated live load of 30 tons on a wheel spacing 8 x 12 ft. It will be used solely for vehicular traffic. The roadway will be wide enough to accommodate four lines of vehicles.



The idea of designing the steel spans as cantilever beams, but yet making them appear as arches, grew out of the physical conditions of the site. A true arch design would have required space for its abutments, in the street and in the Grand Central Terminal building, that could not be spared, and would have involved practically impossible foundation conditions. The girders forming the northerly half of the north span will be supported on columns located at the northerly building line of 42nd St., extending back over these columns to frame into the existing steelwork in the Terminal building. The other girders will be supported individually on two steel columns at the piers or in the approach walls, which will incase both the columns and that part of the girder between them. The girders over the piers are the largest and heaviest, being 136 ft. long by about 12 ft. deep at the supports, and weighing 73 tons each. All of the girders will be fabricated and shipped as units, and erected without field splicing. The meeting ends at the crown of each "arch" will be joined by a horizontal pin through slotted holes allowing a maximum expansion of two inches.



Section at Piers B & B1

FIG. 5. ELABORATE FOUNDATIONS OF VIADUCT MADE NECESSARY BY NUMEROUS SUBSURFACE DIFFICULTIES

The floorbeams are to be of plate-girder sections; the upper side of the web is cut parallel with the crown of the finished roadway. An 8½-in. reinforced-concrete floor slab continuous over the tops of the floorbeams will be covered with four-ply waterproof fabric which will be protected by a 3-in. layer of concrete. On top of this a 3-in. asphalt pavement is to be laid.

The exposed portions of all floorbeams, brackets and inside of the main girders will be covered with 1½ in. of 1:3 cement mortar placed by the cement gun on 2-in. mesh of 12-gage wire, securely fastened to all steel members.

Most difficult foundation conditions confronted the designers. Park Ave. is honeycombed with subway and tunnel structures at the site, as can be seen in the plan, Fig 2. The column footings had to be supported on them or carried around them.

The two southerly pairs of columns will rest on two sets of double girders which span the old or Fourth Ave. subway. The other columns will generally be supported by girders resting on columns located between the subway tracks and on piers built up outside of the subway walls or the columns will rest directly on the subway roof itself. The maximum reaction (400 tons) occurs at the base of the columns in Pier A, which will be placed on high concrete pedestals founded on rock. The columns on the north building line of 42nd St. extend through five finished floors of the Grand Central Terminal building and rest on grillage beams 60 ft. below street level.

Construction work is to be carried on in a manner that will cause the least interference with street traffic. The existence of gas mains, sewers and a 48-in. water main in the western roadway, makes it necessary at one pier to excavate the eastern roadway and carry a drift beneath these structures to the subway roof, so that grillage girders can be placed in position. In addition, a depressed bay will be constructed in the subway roof to accommodate the girders. By setting the girders so as to clear the subway, all danger is avoided of transmitting to the latter any load from the viaduct. The other foundation piers and girders will be placed in the ordinary manner through an open cut.

To avoid side pressure on the subway walls, all adjacent concrete piers will be carried down to the elevation of the wall footing. Protection of the columns between the subway tracks against damage in possible derailment of subway cars is provided by concrete walls extending several bents on either side of the columns.

The completed structure will require 1200 tons of steel, 2000 cu.yd. of concrete and 14,000 cu.ft. of granite; about 2000 cu.yd of excavation will be necessary. The contract form required itemized bids but there is a provision for doing extra work which could not be itemized, on a cost-plus-percentage basis. The Terry & Tench Co. bid of $517,000 was the lowest of six.

The original design of the viaduct was made by Olaf Hoff, consulting engineer, and Warren & Wetmore, architects. Modification of this design was suggested by Eugene W. Stern, chief engineer of highways. As Mr. Stern is absent on military duty the supervision of construction will fall upon Clifford M. Pinckney, acting chief engineer.

Well Condemnation Decreases With Depth

Condemnation of well waters as the result of inspections and analyses by the Illinois State Water Survey for the nine-year period from 1907 to 1916 shows that as the depth of the wells increases the percentage condemned as unsafe decreases. During the period named 11,281 wells were examined and of these 5091, or 45%, were condemned. For wells less than 25 ft. deep the percentage of condemnation was 74; 25 to 50 ft., 63; 50 to 100 ft., 36; more than 100 ft. deep, 14. Of wells with unknown depths the percentage of condemnation was 44, the total number of wells being 636.

The Truth About Imhoff Sewage Tanks at Baltimore

Correction of Misleading Statements—Foaming Difficulties Outlined—Insufficient Sludge Capacity—Cause of Disuse

By Thomas D. Pitts
Lately Engineer in Charge of Sewers, Baltimore

REPORTS have been circulated that "the Baltimore Imhoff tanks are in bad repute * * * that the operation of the tanks became unsatisfactory, sludge foamed over the top, and the condition seemed to be beyond remedy to the extent that the tanks were taken out of service and the further construction of units of this type is not contemplated." This report is just near enough to the truth to be misleading, and therefore it seems worth while to give the facts.

Before construction was started on the Baltimore sewerage system, in 1906, the consulting engineers, Messrs. Stearns, Gray and Hering, outlined for the disposal plant a plan which contemplated the use of septic tanks, sprinkling filters and final settling basins before the effluent was discharged into Back River, an arm of Chesapeake Bay. This outline plan was followed very closely in the contract plans, prepared by the disposal division, Ezra B. Whitman, division engineer, under Calvin W. Hendrick, chief engineer, with the exception that for the primary treatment plain settling tanks are used instead of septic tanks, arrangements being made to draw the sludge off for digestion in separate tanks. Later, it was decided to interpose revolving screens, covered with wire cloth having 26 meshes to the inch, between the settling tanks and the filters, to reduce the trouble from clogging of the sprinkler nozzles by the fine material carried over in the effluent.

Twenty-Eight Imhoff Tanks Contracted For

In 1914 the Sewerage Commission contracted for the construction of 28 Imhoff tanks, anticipating that the flow of sewage would shortly be too great for the settling tanks already installed, and desiring, further, to give the Imhoff tanks a thorough test. These tanks were described and illustrated in both *Engineering News* and *Engineering Record* at the time. They are circular in form, with conical sludge chambers, and are designed for radial, downward and outward flow from a central, circular distributing channel, the effluent being drawn off through V-notch weirs at the circumference. These tanks were designed in accordance with Dr. Imhoff's latest ideas and the plans were submitted to him for approval before the contract was let. Each tank was expected to pass 500,000 gal. of sewage per day, representing about 4000 population, and the volume of the sludge chamber in each tank is 3650 cubic feet.

The tanks were put in service late in 1915 and they were very slow in ripening, no digested sludge being found in them until well into the summer of 1916. During the ripening period the tanks were operated at a very low rate, but as soon as they showed signs of proper bacterial action the rate was increased, and we began to have trouble almost at once with foaming at the gas vents and excessive scum formation. There were times with all the tanks when nothing but liquid was discharged from the sludge pipes, all of the solid matter having risen to the top. We tried various expedients without success, such as breaking up the scum with a hose stream, skimming it off, sinking it, etc., but found the only thing to do was to put the tank out of service for periods varying from a few days to two or three weeks, and then start it again very slowly.

After trying various rates of operation we found that we had little trouble as long as we did not try to pass more than 250,000 gal. per day through a tank, and for nearly two years they were operated at that rate. At the end of that time they were put out of service because the volume of flow was too low to be handled by one of the settling tanks and the Imhoffs, and at the same time not large enough for the running of two settling tanks and the Imhoffs with satisfactory results, especially in the matter of odors. Another reason for discontinuing the use of the Imhoffs was that there was so much loss of head through them that the water level in the channel leading to the screens had to be carried a foot lower than would otherwise have been necessary, seriously reducing the available area of the screens.

To Change Imhoff Tanks and Build No More

We are now planning to change the Imhoff tanks from outward and downward flow to outward, horizontal flow, and to raise the inlet and outlet weirs so that a higher water level will be carried on the screens; and shall put them in service again as soon as the flow increases beyond the capacity of two settling tanks. We do not, however, expect to be able to operate them at a higher rate than 250,000 gal. per day each, as Hammond's experiments in Brooklyn show clearly that, for American conditions, our sludge room is not large enough for a larger population than is represented by that amount of sewage. Our observations indicate, further, that our gas vents are not large enough to take care of the gas generated when the rate of flow is greater than that figure.

It is not likely that we will build any more Imhoff tanks at our Back River plant, because we find the cost, both for construction and operation, to be higher per million gallons than for the settling tanks with separate sludge digestion tanks which were built in the first place. Future tanks will probably be plain settling tanks similar to those we now have, but narrower and deeper, with pyramidal hopper bottoms and with sludge tanks set enough lower to allow the sludge to be run out of the settling tanks by hydraulic pressure, as in the case of digested sludge from the Imhoff tanks. We anticipate that tanks of this design can be operated at about half the cost per million gallons that is shown for the Imhoff by our experience.

I do not believe that the Imhoff tank will prove satisfactory for any plant which has to handle quantities of sewage approximating ours, especially where it is stale, as at Back River, but it may be both satisfactory and economical for smaller plants with fresher sewage, if ample sludge room is provided. I should prefer a longitudinal-flow design in any event, and our experience is that the horizontal flow is less likely to lead to excessive sludge formation than the downward flow used in our tanks. One tank arranged for horizontal flow has given us little or no trouble.

How the War Has Increased the Corps of Engineers

Officers and Men Before War Were Twenty-Five Hundred—Two Hundred Thousand Now—More Than Half in France

WHEN the United States declared war on Germany, Apr. 6, 1917, the corps of engineers of the United States Army consisted of 256 officers and three battalions of engineer troops aggregating 2100 enlisted men. There were also 112 civil employees in the Engineer Bureau. These figures do not include any of the civil employees of the Enginer Department at large engaged on river and harbor and other public works, but do include the officers of the Corps of Engineers detailed to such work. At the present time there are approximately 7800 engineer officers on active duty, of whom about 400 are officers of the Corps of Engineers of the regular Army. The balance are officers of the Engineer Reserve Corps; Engineers, National Army; Engineers, National Guard; and Railway Transportation Corps.

There are at present in various stages of organization some 284 regiments, separate battalions or smaller independent units including the following special services:

Divisional Engineer Regiments.
Mounted Engineer Battalions.
Divisional Engineer Trains.
Forestry Regiments.
Standard-Gage Railway Construction Regiments.
Standard-Gage Railway Operating Regiments.
Standard-Gage Railway Operating Battalions.
Standard-Gage Railway Shop Regiments.
Standard-Gage Railway Maintenance of Way Battalions.
Standard-Gage Railway Maintenance Equipment Battalions.
Standard-Gage Railway Transportation Battalions.
Standard-Gage Railway Trades and Storekeepers Battalions.
Camouflage Service.
Railway Transportation Corps.
Light Railway Construction Regiment.
Light Railway Operating and Shop Regiment.
Highway Regiment.
Supply and Shop Regiment.
General Construction Regiments.
Water Supply Regiment.
Mining Regiment.
Quarry Regiment.
Surveying and Printing Service.
Gas and Flame Regiment.
Electrical and Mechanical Regiment.
Crane Operating Companies, Port Terminal Service.
Auxiliary Forestry Battalions.
Service Battalions.
Motor Transportation Companies.
Pontoon Trains.
Army Pontoon Park.
Engineer Depot Detachments.
Engineer Training Regiments.
Corps Engineer Regiments.
Replacement for Engineer Units.
Inland Waterway Companies.
Military Mapping Service, and Gas Training Service.

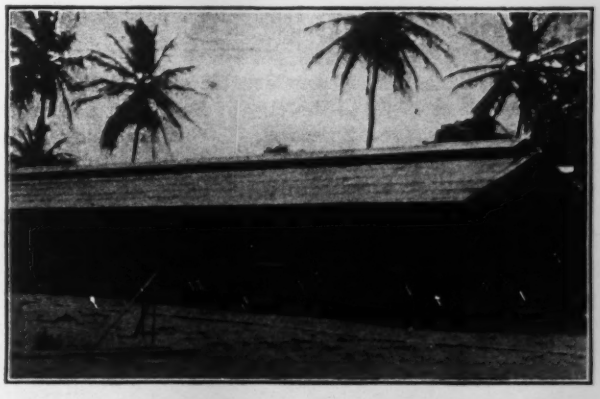
The total authorized enlisted strength of the above organizations is 231,000. The actual enlisted strength of all engineer troops is now 200,000, of which some 110,000 were in France the middle of June. In addition there are approximately 315 civil employees in the Engineer Bureau.

Porto Rico Army Camp Designed for Tropical Conditions

Ideal Site Near San Juan in Hills by Ocean—Designs Made More Airy—Sanitary Details Raise Standard in Island Territory

ALTHOUGH the huge army camps which engineers and contractors put up so rapidly last summer have been described over and over until every one must recognize their general appearance and know the details of their design, the cantonment being erected in subtropical surroundings in Porto Rico has developed decided revisions in the types of buildings used. The climate made easy the selection of a site much more inviting than was possible for the camps in the states. In consequence, there is building near San Juan a cantonment familiar in its general appearance, but at the same time of a type indigenous to the country. For engineers who have had or will have experience in the tropics it is worthy of note that the high grade of conditions sur-

LOCAL WORKMEN ERECT WITH SPEED AND EFFICIENCY THE WOODEN BARRACKS FOR CANTONMENT



TYPICAL BARRACKS HAVE NO GLASS WINDOWS BUT LOUVER SHUTTERS AND OPENING UNDER EAVES

rounding the laborers building the camp has had a stimulating effect on the morale of the natives and has markedly increased the productivity of the workmen.

The site for Camp Las Casas covers several hundred acres about five miles southeast of San Juan. It borders on one of the best suburban residential sections and is reached by the Carretera, one of the famous military roads built by the Spaniards. It is on a high, sandy ridge rising from 50 to 100 ft. above sea level and jutting out along a lake of considerable size directly connected by a waterway to the city of San Juan and only a short distance from the ocean. The soil is sandy, and almost the entire tract is covered with beautiful cocoanut palms, mangoes and other tropical trees, most of which have been saved, thus adding materially to the appearance of the camp.

THE UNITED STATES ARMY BUILDS A CANTONMENT AT SAN JUAN IN PORTO RICO ON THE SHORES OF A LAKE AND ALONGSIDE THE OCEAN

STREETS AND ROADS OF CANTONMENT NEAR SAN JUAN, PORTO RICO, LAID OUT THROUGH TROPICAL FOREST WHICH WILL BE PRESERVED

The standard building plans of the other cantonments were adopted by the Government, with modifications required by the climate. No glass, for instance, is used on the island, so in this camp louvered shutters cover the windows, all openings being protected by screens against flies and mosquitoes. The eaves of all buildings are board, and the walls are left entirely open for a space of a foot or more under the projecting roofs, to permit the greatest circulation of air inside the barracks. The temperature in Porto Rico in winter averages 73° and in summer 79°, so that a practically open building can be used.

Special effort was made to maintain the highest grade of sanitary services in the camp. A complete sewer system was installed and an abundant supply of pure water arranged for. It is stated that the high standards kept have had a favorable reaction in the adjoining community. The officer in charge found upon his arrival that the sanitary conditions of the city of San Juan were not as good as they might be. Whether it was due to politics, lack of money, or other influences, the fact remains that sewerage facilities, proper plumbing, lavatories and cesspools were in many places lacking. Realizing that the health of the soldiers in the camp would depend very largely on the sanitary conditions of the city, this officer started a campaign which resulted in arousing not only the officials but the population at large to an effort to improve sanitary conditions. At this time they have planned an incinerator for the destruction of garbage, new sewers, cesspools and public

latrines, all of which when completed will do much to make the city more sanitary and safe. The elimination of flies, too, has been taken up by the local authorities and, following the advice of the army engineers, a campaign is now on to destroy these pests.

Labor conditions have greatly improved since work started. The engineers, together with the labor superintendents, were all Americans, many of whom had been employed in similar work during the past summer in the States, but the other labor was secured locally. The Porto Rican peon laborer at first was unsatisfactory. Generally he was lazy, inefficient and dull when he first came to work, but it has been proved on this job, that a large part of these defects are caused by lack of nourishment. The Porto Rican workman is very ignorant on the question of food, and subsists largely on bananas, beans and coffee. His food is cooked with a great deal of grease, eaten in unsanitary conditions and irregularly. On the camp work a mess was established and these workmen received three good meals a day. Reports came in at once that their efficiency had increased at least 50%. When properly fed and managed by skilled workmen, these laborers were found most satisfactory and carried on the work expeditiously and well. There is no doubt, too, that the native workmen will act as missionaries to carry back to their homes the gospel of cleanliness and the effectiveness of well prepared food they learned in camp. There was a little delay in starting due to the holding up of materials which came from the States, but this was overcome by local purchases.

The construction of Camp Las Casas is directly in charge of Major Ernest B. Steward, Corps of Engineers, N. A., with Capt. G. A. Watkins, N. A., as assistant constructing quartermaster, and Charles B. Burdick, of Alvord & Burdick, Chicago, as supervising engineer. The contractor is the Purdy & Henderson Co. of New York City, with N. A. Richards, vice president and general manager, in charge. Camp Las Casas was so nearly completed by June 1 that the 6000 men called then could be accommodated. It is now practically completed.

Ultimate Costs of Bituminous and Water-Bound Macadams Nearly Equal in New York

Highway Department Investigation Indicates Total Tonnage Affects Cost But Slightly—Equation Derived for the Relation of Ultimate Cost to Traffic Tonnage

By Dudley P. Babcock
Assistant Engineer, New York State Highway Department

WATER-BOUND and bituminous macadam pavements were found to be almost equal in ultimate cost, in recent investigations of these types made by the New York State Highway Department. The results were interesting and quite unexpected, not only in that there was so small a difference between the two types, but also because it appeared that traffic tonnage has a very small effect upon the ultimate cost. Some interesting data in regard to the average daily traffic on the highways of the state were also collected.

The advent of motor vehicles and the consequent introduction of various new types of pavements have raised the question of the ultimate cost of highways, and this has become a vital and complex issue throughout the entire country. The term "ultimate cost" not only comprehends the first expenditure, but also covers the outlay for maintenance, repairs, and resurfacing. In other words, it is everything that its name implies from an economic point of view. More specifically, throughout the study of New York state highways, which has been made under the direction of the State Highway Commissioner, the ultimate cost has been considered the amount of money spent by the people of the state per year, in order to build, repair, resurface, and at periods of time far apart reconstruct each square yard of pavement. In view of the limitations put upon it, this study does not attempt to go beyond the pavement. Notwithstanding this fact, figures illustrating the cost of excavation, subdrainage, culverts and the like would be distinctly pertinent to the discussion.

It seemed practicable to include in the study only the shorter lived types of pavement, as water-bound and bituminous macadams, as the more permanent types, as brick and concrete, are of such recent development compared with their probable length of life that even tentative conclusions are hardly warranted. However, in the case of macadam types, many of the roads analyzed were old enough to form a basis for such conclusions. To aid in the more complete estimate of the cost of these roads, extensive statistics had been collected and were available for comparative study.

Treating, first, the ultimate cost, it may be resolved into the following factors:

(1) First cost per square yard; (2) length of time before this expenditure will have to be repeated; (3) interest on bonds; (4) cost of maintenance and repair per year; (5) cost of resurfacing, which is somewhat less than the first cost, inasmuch as resurfacing does not generally include the replacing of the bottom course; (6) the time interval between the resurfacings.

Factors 1, 3, 4, and 5 are easily obtainable from the records kept by the department. The number of years over which the expenditure for construction and the periodical expenditures for resurfacing may be considered to extend are more difficult of deduction. It will be assumed that the life of the pavement extends from the date of construction to the time when it will have to be entirely rebuilt at an expense approximating the original cost. Thus, if the original cost of construction is assumed to be 70c. per square yard, and the depreciation, notwithstanding ordinary maintenance and repair, is assumed to be 2c. per square yard per year, the term of the bonds would then be $70 \div 2 = 35$ years. The classification in one item of the resurfacing and the

TABLE SHOWING RESULTS OF INVESTIGATION OF ROADS UNDER CLASSES I AND II, INCLUDING ULTIMATE COSTS AND THEIR DISTRIBUTION

Type	Class	No. of Roads Studied	Mileage	Time Limits of Original Construction (Inclusive) From	To	Average Period, Years	Average Ultimate Cost per Sq.Yd. per Yr. Cents	Distribution: Average Depreciation per Sq.Yd. per Yr. Amt. Cents	% of Total	Average Maintenance and Resurfacing per Sq.Yd. per Yr. Amt. Cents	% of Total	Average Net Interest on Investment per Sq.Yd. per Yr. Amt. Cents	% of Total
Waterbound macadam	1st	79	300	1902	1912	6.3	11.4	2.0	17.0	7.88	69.0	1.55	14.0
Waterbound macadam	2nd	108	410	1902	1910	7.6	13.7	5.5	40.0	6.7	49.0	1.5	11.0
Bituminous macadam	1st	11	44	1909	1910	4.74	12.2	2.0	16.4	8.49	69.7	1.69	13.9
Bituminous macadam	2nd	67	257	1909	1910	6.3	14.0	7.57	54.2	4.48	32.1	1.91	13.7
Waterbound macadam resurfaced with bituminous	2nd	21	68	Built 1902–1907	Resurfaced 1909–1910	12.7	13.5	2.6	19.3	9.6	71.1	1.3	9.6

ordinary maintenance and repair obviates the necessity for distinguishing between the two.

Two methods of arriving at the ultimate cost suggested themselves, and the department grouped the roads studied in two classes. The assumptions determining the classification have in each case their peculiar disadvantages, but it was felt that a fairly equitable value would be obtained if the two methods were used independently and the results averaged.

In the first class were grouped those roads which had just been resurfaced, or which because of thorough maintenance and repair were considered "just as good as new"; with the exception of a small charge for depreciation. In the second class, those roads were grouped which had been built five years or more. They were selected irrespective of the condition of the road at the end of the period.

Determining Ultimate Cost

Taking up the first class, the ultimate cost was deemed to be made up of (1) An arbitrary depreciation charge, which was placed at 2c. per square yard per year; (2) maintenance and resurfacing per square yard per year; which item included the summation of all maintenance, repairs and resurfacing, divided by the number of years since the original construction; and (3) interest on the first cost per square yard at 2% per year, which is approximately the net interest per square yard per year at 4% on the investment. It is made up of the annual interest at 4% on the cost per square yard, minus the average interest per square yard per year at 4% on the invested sinking fund. Considering a road with a 35-year life, this last item would be the interest per square yard on the sinking fund in the 17½ years. While 2% of the first cost per square yard does not give exactly the net interest per square yard per year, as figured by compound interest, still it is close enough for the purpose of this study.

This may be shown analytically as follows; let c = the original cost of the pavement per square yard; d = the depreciation per square yard per year; c/d, the life of pavement = L; $c/2$ the total amount of money per square yard deposited in the sinking fund by the $L/2$ year. Interest rate = 4%; then net interest = 0.04c. —0.04 $C/2$ = 0.04c — 0.02c. = 0.02c.

A concrete example may help the reader to follow the method of analysis used with the first class. Assume that a road has just entered its eighth year, and that the original cost of the paving was 70c. per square yard; that every year 2c. per square yard has been expended for patrol, oiling, repairs, etc.; and that at the end of every seventh year it must be completely resurfaced at a cost of 42c. per square yard. Assume, further, that at the end of 35 years not only the top course but the bottom course also must be entirely renewed at the original cost. The road, having just been resurfaced, would then appear to be "just as good as new," and would be in the first class, but as a matter of fact there would be a small depreciation charge due to the fact that the resurfacing did not include the renewal of the bottom course. The ultimate cost per square yard per year would then be as follows:

	Per Square Yard Per Year.
Depreciation 70c./35	$0.02
Maintenance	02
Resurfacing 42c./7	06
Maintenance and resurfacing	08
Net interest chargeable, 2% of $0.70	014
Ultimate cost	$0.114

Next, considering the second class, the depreciation was assumed to be one-half of the first cost divided by the number of years covered. This was done because some of the roads included were as good as new, others were half depreciated, and still others were in almost a worthless condition; thus, the average road might be considered one-half depreciated. Therefore, the ultimate cost of the pavement would be the sum of this depreciation per square yard per year; the maintenance and resurfacing per square yard per year; and the interest on the first cost per square yard at 2%. The last two items were figured the same as for the first class.

Results of the Investigation

The results of the investigation, under the two classifications, of 286 macadam roads, of both the waterbound and bituminous types, are shown above in tabulated form. In the first class, 79 water-bound and 11 bituminous roads, with an aggregate mileage of 300 and 44 respectively, were studied. Under the second class, 108 water-bound and 67 bituminous roads were studied, their respective mileages being 410 and 257. Twenty-one water-bound macadam roads which had been resurfaced with bituminous coverings were studied under the assumptions for the second class, although these were not exactly applicable. The table shows the data mentioned above, the years between which the roads studied were built, the average period studied, and the average ultimate cost per square yard per year. The distribution of the average ultimate cost among the separate items and their percentage of the total are also tabulated.

It seems probable that the figure derived from the first class, for the ultimate cost of water-bound macadams, is under rather than over the correct value. This is due to the assumption that the top course at the end of the specified time was as good as new. This, in many cases, was probably not strictly true. On the

other hand, the figure derived from the second class is more likely to be high than low. The assumption made for the latter was that the original cost of construction was half used up at the end of the specified period. It is probable that the bottom course, especially in the newer roads, was about as good as new, and that in the case of the older roads it was not more than half used up. If, then, these two classes give, respectively, results that are too low and too high, the true ultimate cost of water-bound macadams lies somewhere between 11.4c. and 13.7c.—say, 12½c. per square yard per year. The same method of analysis applied to the bituminous macadams gives an average ultimate cost of 13.1c. per square yard per year.

Practically all the bituminous roads constructed between 1909 and 1910 were included. The first year in which the state actively constructed bituminous macadam was in 1909, and no roads built after 1910 were taken. It was thought that subsequent construction had not been in place long enough to determine the charge for maintenance and repair. As explained under water-bound macadam, the first class included only roads which had just been resurfaced. Only 11 roads could be found which were constructed of bituminous macadam prior to 1911, and which had been resurfaced with the same material prior to 1917.

When it is remembered that the traffic on the water-bound macadams was probably considerably less than on the bituminous pavements, the ultimate cost of the latter compares very favorably with that of the former. While the first cost of the bituminous macadams was higher than that of the water-bound macadams, this was apparently offset by a relatively lower maintenance charge. The small variation in the ultimate cost between the two classes studied is remarkable, if we consider the widely different assumptions that were made. Each class was figured completely before being compared with the other.

The relation between traffic tonnage and ultimate cost was next investigated by comparing the results, as obtained by the study outlined above, with the traffic censuses of various roads which were taken by the department in the year 1914. The number of roads considered in the 1909 census was too small to use in any analysis covering the whole state. The statistics taken in 1914 and 1916 were fairly complete, and summaries of the results in number of vehicles, their tonnages, distribution, percentage of the total, and total increases and decreases are shown in the tables printed herewith.

The 1914 tonnage per 12-hour day, reduced to the equivalent for a 16-ft. width of road, was plotted horizontally on a chart, and the ultimate cost per square yard per year was plotted vertically. For example, if the traffic census shows the tonnage on a 12-ft. road to be 1200 tons per day, the equivalent tonnage adjusted for a 16-ft. highway would be 1600 tons. Only the water-bound macadam roads were used in this part of the investigation, and the ultimate costs and tonnages of each were plotted.

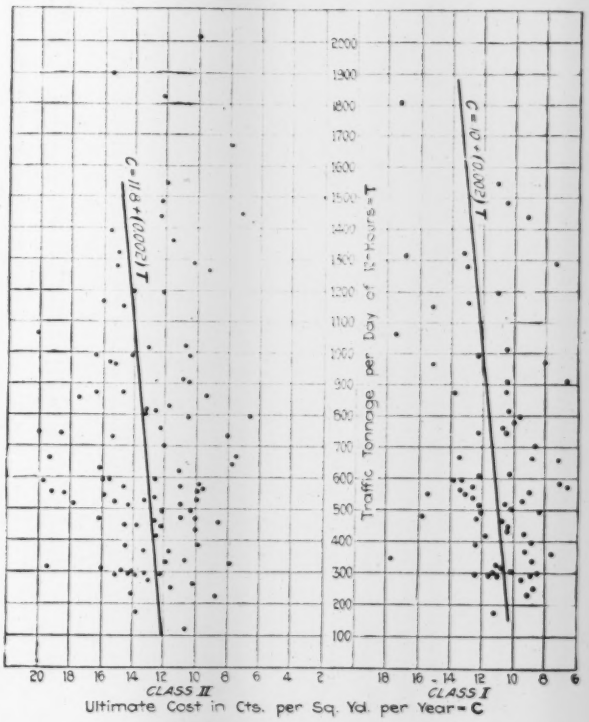


CHART SHOWS RELATION BETWEEN ULTIMATE COST OF MACADAM ROADS AND TONNAGE

The straight line which most nearly approximated the points, and which is shown on the illustration, was obtained by plotting the figures from the 79 roads included in the first class. It was found to have the equation $C = 10 + 0.002\ t$, where c equals the ultimate cost in cents per square yard per year, and t equals the traffic tonnage per day of 12 hours. The 108 roads included in the second class were plotted, and the equation resulting was $c = 11.8 + 0.002\ t$. Taking a rough average of these equations we have $c = 11 + 0.002\ t$, which, it is fair to assume, is the equation expressing the relation between traffic tonnage and ultimate cost.

The large number of roads used in obtaining this equation seems to warrant the tentative conclusion that the traffic tonnage has relatively small influence on the ultimate cost of water-bound macadams. The maintenance and repair necessitated by traffic tonnage seem

TABLE SHOWING AVERAGE NUMBER OF VEHICLES, THEIR DISTRIBUTION, PERCENTAGE OF TOTAL, AND PER CENT. CHANGE IN PERIOD

Year	No. of Roads Averaged *	Average No. Vehicles per Day of 12 Hours	Horse Drawn No.	Horse Drawn %	Autos and Motorcycles No.	Autos and Motorcycles %	Motor Trucks No.	Motor Trucks %
1914	510	352	168	48	172	49	12	3
1916	797	433	103	24	309	71	21	5
% Change in 2 yrs...	...	+23	—39	..	+80	..	+75	..

* Note.—The average length of roads may be taken at 3.77 miles.

TABLE SHOWING AVERAGE NUMBER OF TONS CARRIED IN TWELVE-HOUR DAY, THEIR DISTRIBUTION, PERCENTAGES OF TOTAL AND PER CENT. CHANGE IN PERIOD

Year	No. of Roads Averaged *	Average Tonnage 12-Hr. Day†	Horse Drawn Tons	Horse Drawn %	Autos and Motorcycles Tons	Autos and Motorcycles %	Motor Trucks Tons	Motor Trucks %
1914	902	630	184	29	375	60	71	11
1916	797	853	111	13	609	71	133	16
% Change in 2 yrs...	...	+35	—40	..	+62	..	+87	..

* Note.—The average length of roads may be taken at 3.77 miles.
† Based on assumption of following weights: Motorcycles = 0.2 tons; automobiles = 2.1 tons; motor trucks = 6.2 tons.

to be hardly more than 15% of the total cost of maintenance and repair.

The elements of uncertainty entering into these studies may be summarized as follows: All maintenance and repair were estimated to apply to pavement. As a matter of fact a small percentage was used to clean ditches, repair culverts, etc. The traffic statistics were obtained by patrolmen, and their accuracy is doubtful. The effect of traffic on the deterioration of the pavements is probably slightly larger than the equations would indicate. This is due to the fact that the roads of heavy traffic were in most cases more easily accessible, being nearer centers of population and railroad centers, and were therefore cheaper to build and maintain. The assumption of 2c. as the deterioration rate used for the first class was purely arbitrary; however, it represents only about 16 per cent. of the total, and this compared very well with results obtained for the second class. The traffic tonnage was used for the year 1914, and was a very rough measure of the relative traffic for the entire period.

Furthermore, it may be noted that the road construction of New York State has been variable in quality, and that roads built during some periods would probably make a better showing than those built in other periods. Therefore, the figures developed are, in a considerable measure, relative, and cannot be used blindly in comparison with other work elsewhere which has been done in different circumstances and under local conditions.

In conclusion, the writer desires to state that while the above analysis is far from giving an accurate solution of the ultimate cost of highways, it is (as far as he is aware) one of the first attempts of its kind.

Reports Show Results of Motor Parcel Post Service

Gross Earnings of $40,000 Per Year Per Route Indicated—Hope to Expend $200,000,000 Of Earnings to Build Roads—Aids War by Saving Transportation

GROSS earnings of $304,436 per year, or approximately $40,000 per year for each of the eight routes operating during the period between Dec. 1, 1917, and May 31, 1918, were indicated by tabulations and reports submitted to the Committee on Post Offices and Post Roads of the House of Representatives at its meeting held June 21. James I. Blakslee, fourth assistant postmaster general, submitted the information and told the committee that the motor trucks operating over the eight routes have traversed 201,811 miles of highway at an average cost of $0.1442 per mile.

The evidence was presented in support of a joint resolution in Congress permitting the Post Office Department to expend 50% of the gross earnings of the motor parcel post business in the building of post roads throughout the United States. It was estimated that such a system of roads would cost in the neighborhood of $200,000,000. It was asserted that the establishment of the motor parcels post would help to relieve the transportation difficulties of the country, and that such a system of roads, bringing the motor express directly to the door of the farmer, would greatly increase production by allowing him to work during the time which he would otherwise have to use in going to market. Thus, this service would help greatly in winning the war, it was asserted. A map showing the proposed system of roads east of the Mississippi River was also submitted, and, together with the tables mentioned above, is shown in the drawing. An abstract of the report submitted by Mr. Blakslee and a discussion of the tables follows.

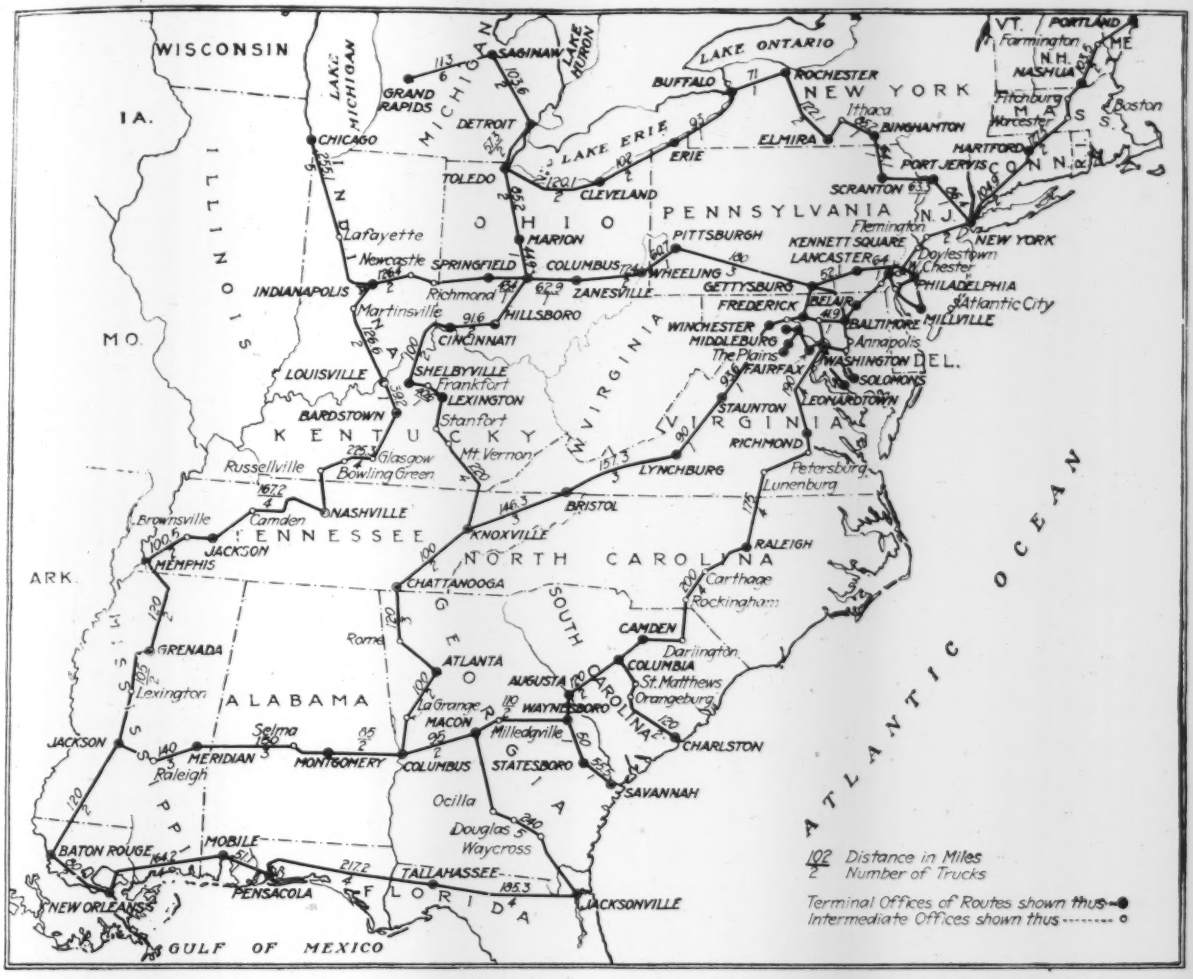
The Post Office Department has long considered establishing this form of parcel post service, and believes the transportation conditions due to the present war have greatly emphasized its desirability. It was felt that any relief of the present congestion of rail facilities would have a direct bearing upon the winning of the war, and greater attention has been given to the problem recently. Experimentation has shown the many advantages to the mail service of direct connection by motor truck between the various post offices. The great convenience of transporting mail matter directly from the door of the producer to the door of the consumer is also evident, and the consequent saving of man power, which is so precious at this time, would, it is believed, amply justify the necessary expenditure.

The success and the efficiency of operation of the motor parcels post was deemed to rest upon three conditions. The first of these is the interest and coöperation of the patrons, and this could not be obtained until they were first shown the value of the service. The second depends upon economical operation of motor vehicles in reference to first cost, maintenance and capacity for delivering goods with profit to the operator. Third is proper highways over which to operate. To arouse interest and also to obtain information in regard to proper methods of motor truck operation, the Post Office Department decided to establish several routes over good roads, in various parts of the country. Wherever this service has been established, it has been well received, and the interest and coöperation of the public seem assured. The successful operation of the

TABLE SHOWS THE OPERATING COSTS AND EARNINGS OF THE UNITED STATES

Route No.	From—	To—	*Gasoline— Gallons	*Gasoline— Cost	*Grease and Oil Cost	*Tires and Tubes	*Repairs— Labor	*Repairs— Material	*Accessories	*Garage	*Salaries of Carriers	†Supervision P. O.	†Supervision Dept.
10738	Philadelphia..	Atlantic City..	2,888	$686.84	$51.44	$400.28	$335.60	$43.55	$16.40	$145.72	$942.03	$222.00	$165.72
13283	Baltimore.....	Solomons.....	2,866	697.97	92.83	373.77	132.31	42.04	25.78	141.74	1,068.82	88.31	425.31
13293	Washington...	Leonardtown..	3,814	874.94	163.72	695.85	358.95	327.48	.....	111.76	1,432.26	32.75	555.19
13299	Washington...	Baltimore.....	3,345	804.46	151.07	391.70	277.85	47.92	23.53	125.11	1,578.50	134.31	477.68
13300	Baltimore.....	Lancaster.....	2,497	671.09	143.50	401.36	64.01	5.89	8.03	67.00	963.87	58.10	287.79
13301	Philadelphia..	Washington...	4,863	1,247.01	148.04	825.62	189.05	60.22	40.72	216.70	1,856.04	276.00	597.61
21271	Savannah.....	Statesboro....	516	134.82	33.29	127.49	3.90	.70	.....	27.50	300.00	45.50	31.87
31313	Columbus.....	Zanesville.....	847	208.51	40.00	210.85	27.15	.30	2.00	29.33	287.21	3.70	37.23
Totals and averages			21,636	$5,325.64	$823.89	$3,426.92	$1,388.82	$528.08	$116.46	$864.86	$8,428.73	$860.67	$2,578.40

* Total direct expenses, $22,305.23; cost per mile, $0.1105. Percentage of indirect to total expenses, 23%.
† Total indirect expenses, $6,794.40; cost per mile, $0.0337. Percentage of direct to total expenses, 77%.



PROPOSED ROUTES, DISTANCES, AND NUMBERS OF TRUCKS FOR SECTION EAST OF MISSISSIPPI RIVER

routes already established fully justify this conclusion. Knowledge pertaining to the solution of the second condition mentioned above was obtained by keeping accurate cost data of operation on all the routes, including every conceivable cost of operation, both direct and indirect charges. Great care was taken in determining these costs, and they are as accurate as could be obtained without unnecessarily delaying the mails.

The accompanying table shows the method of cost keeping. The various items are so arranged that the cost on each route and the average of all the routes can be easily determined. This not only allows for a general average, but also, where routes are in different sections of the country, a good idea can be obtained of the operating costs under different climatic and topographic conditions. Items are also arranged in such a manner that the direct and indirect charges can be kept separate, so that at any future date an analysis of the results can be made along either line. It is not expected that the overhead charges will increase in proportion to the direct charges as the service is expanded, since the departmental charges will be the same in some cases in any event. Considering the different sections of the country in which the trucks operate, some of the charges are very uniform. The average miles per gallon of gasoline are 9.33, with a variation between 8 and 10. The average cost per mile is also very uniform, ranging from 11 to 16c., the average figure being about 14c. The columns containing tons of mail and earnings are less uniform, and the earnings for such small tonnages

MOTOR PARCELS POST FOR SIX MONTHS, FROM DECEMBER 1, 1917 TO MAY 31, 1918

†Interest	†Depreciation	*Miscellaneous	Total Cost	Total Mileage	Cost per Mile	Miles per Gal. of Gas.	Maximum Cost of Trucks	Max. No. of Trucks	Service Established	Mail Transported Tons	Gross Earnings	Net Earnings
$33.05	$368.48	$154.66	$3,565.77	24,565	$0.1452	8.51	$3,771.92	2	Jan. 9, 1918	35.50	$2,705.25	—$860.52
52.63	405.34	462.61	4,009.44	25,573	.1568	8.92	4,545.32	2	July 1, 1917	107.50	33,604.82	29,595.38
61.67	496.13	168.32	5,279.02	33,524	.1575	8.79	9,993.00	5	July 1, 1917	192.75	40,655.04	35,376.02
52.13	445.37	24.39	4,534.02	29,690	.1493	8.88	5,601.70	3	Dec. 10, 1917	96.75	23,135.34	18,601.32
34.37	383.79	118.56	3,207.36	25,585	.1254	10.25	4,023.59	2	Dec. 17, 1917	69.50	19,972.22	16,764.86
66.96	737.81	456.09	6,717.87	49,187	.1366	10.11	5,796.33	3	Dec. 17, 1917	116.00	28,717.67	21,999.80
11.11	75.43	17.20	808.81	5,029	.1608	9.75	2,222.77	1	Mar. 1, 1918	10.00	1,064.64	255.83
11.19	119.87	.....	977.34	8,658	.1129	10.22	1,920.76	1	Mar. 4, 1918	10.50	2,362.76	1,385.42
$323.11	$3,032.22	$1,401.83	$29,099.63	201,811	.1442	9.33	$37,875.39	19	.....	638.50	$152,217.74	$123,118.11

Percentage of indirect to direct expenses, 30%

seem high. It must be noted, however, that the rate for transportation of mail matter is relatively high, and cannot be compared with that for general merchandise. Computing the cost of transportation per ton, it will be seen that it varies from $27.39 for Route 13,293 to $100.44 for Route 10,738. The latter route had the smallest tonnage, considering the time of operation, of any of the eight, being the only route which was operated at a loss. In every case it will be seen that the trucks carrying the greatest tonnage had the lowest operating cost per ton. The net earnings from the operation of all these routes was $123,118.11. Up to Jan. 21, routes 13,283 and 13,293 required only one truck and up to Jan. 11, route 13,299 required only two trucks. Until Feb. 4, route 13,300 required only one truck, and up to Jan. 10 route 13,301 required only two trucks. The extra trucks shown in the table were put on as the service grew in popularity. The cost of trucks given in the table does not include the cost of tires and tubes which is about $358 for each truck. The trucks were operated six days per week.

Good Highways are Essential

After the service is popularized and it is ascertained that it can be operated at a profit the third and most essential condition in the success of this operation is a good highway surface. Experience has shown that unless a highway is usable every day in the year, so that motor trucks can operate with reasonable regularity, no great revenues will be returned to the department. The resolution now before Congress is the result of this conviction, and the purpose is to produce a system of roads which will be available for motor-truck traffic at any time. Inasmuch as the tables show a considerable profit to the Government from this service, it hardly seems fair that the various states should be required to stand the cost of building and maintaining the highways over which it will operate. Therefore, the suggestion is made to make the service pay for its own roads, which, at the present rate of earnings, it will be capable of doing. The intention is to have this plan carried on in conjunction with the various states, but it is not intended in any sense to replace routes which the various states are building or to interfere with the existing systems already built.

With these ideas in view, the Post Office Department made a survey of possible through and connecting routes east of the Mississippi River, and found that there are approximately 7500 miles of highways which should be covered, and that at least 5000 miles would be absolutely essential to the successful operation of motor-truck service. For the section west of the Mississippi no map has as yet been prepared, but it is assumed that at least a similar mileage would be necessary in that region. The territory east of the Mississippi River has three general north and south routes and four east and west routes. Various minor routes are also shown. The larger cities connected and the distances between them are also shown.

An estimate made by the Post Office Department, which will be confirmed by qualified engineers, shows that a mile of permanent road, exclusive of bridges and municipal streets which are already completed, would cost about $20,000 per mile. This contemplates using every possible ecomical method of construction, including convict labor where available, prisoners of war, and local roadmaking materials. If it were decided to build the entire 7500 miles, this could be done at a cost of $150,000,000. The type of road to be built would consist of either concrete or brick surface and would be not less than 16 ft. wide. The thickness of the paving would be not less than 9 in., with a first-class foundation thoroughly underdrained for the entire distance. No other type of road construction would be considered, because, it is believed, only a hard surfaced permanent road will stand up without excessive maintenance charges under the stress of modern motor-truck traffic.

Economics of Problem Discussed

Admitting the foregoing conclusions and consulting the tabulated costs and earnings in the table, a statement of the economics of the problem may be shown by the following example: Suppose it is determined to operate one thousand routes in the territory east of the Mississippi. It will be seen from the table that the eight routes already established are showing gross earnings of more than $300,000 per year. This is nearly $40,000 per route yer year, and it is fair to assume that when business is further developed these figures will be considerably exceeded. On this basis the one thousand routes east of the Mississippi would produce $40,000,000 annually. From this sum must be deducted $5,000,000 for cost of operation; $10,000,000 for indirect cost of transportation of mails to and from routes, and $5,000,000 for extensions and additional service; leaving $20,000,000 per annum which could be applied for the construction and maintenance of national highways. In like manner, the addition of 5000 routes west of the Mississippi would raise the earning power of the entire system to $400,000,000 per year, which is more than the total annual postal revenues at this time. If the estimate of 10,000 routes is considered excessive, it is only necessary to consider that there are, at present, 60,000 rural and star routes in operation.

Postal Revenues not Endangered

It has been suggested that these new routes would cut down present postal revenues to a considerable extent, but assuming that there are 1000 routes which would not interfere with the postal revenues, then the surplus earnings of these 1000 routes would, in due time, build and maintain the proposed Federal system.

The Post Office Department feels that such a system of highways would not only be of great value to the transportation of parcel post, but also would be a great national asset. It would be a valuable addition to our system of national defense and would furnish a means for carrying the increasing motor-truck traffic necessitated by the lack of other forms of transportation. Of course, this scheme would have to be carried out with due regard to the present conditions and to the winning of the war, but a judicious program prepared now and partially introduced, would, the department feels, when entirely developed, be an extremely valuable national resource.

Construction Problems Many in Building Concrete Ships

How the Shipping Board Is Preparing for the New Government Construction Told by Messrs. Wig and Hollister at Meeting of American Concrete Institute

BUILDING concrete ships is a new art, though its elements are all old. Consequently, many problems arise in the construction which require solution before work can start. The concrete ship department of the Emergency Fleet Corporation has been studying these problems for some months, preparatory to starting construction of the 42 concrete ships now under contract by the Government, and the progress the department has made was outlined in a paper delivered before the recent annual meeting of the American Concrete Institute by Rudolph J. Wig, chief engineer of the department, and S. C. Hollister, engineer of design. In the following abstract is given the portion of the paper relating to the construction problems, and in a later issue will be abstracted that section devoted to the design of the concrete ship.

Concrete Must Be Light and Strong

The first thought of most engineers with regard to materials for the concrete for a ship is to use such as will provide the densest mixture possible. Concrete of high density also has a high unit weight. Our problem is fourfold: The concrete must be durable and impermeable to water; it must have a compressive strength of at least 4000 lb. per square inch at 28 days, and a minimum weight. To meet these conditions we have determined upon the use of a rich mortar mixture.

Any standard portland cement which will meet the specifications of the United States Government may be used, provided the fineness is increased so that at least 90% will pass a No. 200 sieve. The greater fineness is required in order to obtain greater strength and a more plastic mixture. Such a cement is also more volume constant.

For the present the maximum-size aggregate is limited to ½-inch. A sand and gravel or a volcanic ash or specially burned clay may be used. The commercial future of the concrete ships is in large measure dependent upon obtaining a light-weight concrete. Investigations made are quite promising. The strength and weight of one of these mixtures which meets our requirements is as follows: One part cement, to one part special fused clay below ¼-inch size to two parts same aggregate between ¼ and ½-in. size, had a compressive strength of 3380 lb. per square inch at seven days and 4350 lb. per square inch at 28 days. It weighed 106 lb. per cubic foot in a saturated condition.

With the use of this material the ratio of the deadweight to total displacement will be 62% for the 3500-ton ship as compared with 65 to 68% for a steel ship and 53% for a wood ship.

No integral waterproofing compounds of any kind will be used in the mixtures.

Forms Must Be Accurate

The form problem is a most intricate and difficult one. The forms for practically the entire ship must be placed before concreting starts. The accuracy of placing must be much greater than in ordinary building construction, for if the spacing is slightly oversized, it results in increased tare weight of the hull, which, of course, decreases the cargo capacity of the ship. The relatively high unit stresses and the small thickness of covering for the steel also requires unusual accuracy in placing the forms.

There are a number of ways of constructing the forms. They may be of wood or metal, or of wood lined with metal. It has also been suggested that plaster forms may be used. They may be built in panels or as one unit, to be later removed, board by board. The inside forms may be first constructed and the outside forms placed after the steel is fabricated. A more common method is to place the outside forms first, fabricate the steel, and then place the inside forms. The former method is being followed in the construction of one ship for the Emergency Fleet Corporation, but the latter method will be used on subsequent ships. Much time and money can be lost or saved in forming, and much thought and study can profitably be given to this work. In Norway there is one company building small craft by the so-called "upside down" method, in which the inside forms are fabricated in an inverted position. The concrete is shot into place with a gun, or applied by hand, a relatively stiff mixture being used. No ships are being built by this method in the United States.

Reinforcement Small and Accurately Placed

Reinforcing steel which we are using, other than fabric, is of rods or bars rolled from new billets to conform to the American Society for Testing Materials standard specifications for structural grade new billet steel. Plain round bars will be much easier to fabricate than deformed bars, but on account of the uncertainty of the effect of reversal of stress we are using deformed bars wherever the bond stress is high.

The accurate bending of the reinforcing steel is one of the most difficult of all the construction problems. With a wall thickness of only 3½ to 4 in., and two to three layers of steel, need for accurate bending of the steel can be readily appreciated. Furthermore, the curvature is constantly changing forward and aft in the vessel, which requires constant change in the location of the dogs on the bending table. The use of small steel is recommended, in that it is easier to spring into place if the bending is not accurately done.

With a very large quantity of steel, approximately equivalent to 10% of the carrying capacity of the ship, to be placed in a very small space in thin walls, there is much opportunity for the development of ingenious methods of fabricating the steel. Undoubtedly, much time can be saved by prefabricating, at least in part, the steel of the frames and placing them in the ship as units. These frames may be as much as 54 ft. in width and 35 ft. in height, and they must be accurate to within a fraction of an inch. Through a length of 60% of the ship the shape of these frames is constantly changing. All the steel must be supported and secured so that it will not touch the form surface. Numerous

methods have been suggested, and there are a number of chairs now on the market for supporting steel, but all of them have objectionable features.

A study has been made of welding methods and machines as a means of avoiding the lapping of the steel. The acetylene weld is rather uncertain and not satisfactory. The electric resistance weld appears to be the most promising. Several machines of this type have been ordered and are now being tried out. The bond stresses are exceedingly low in the longitudinal steel and there is more space available for lapping. In the frame steel, however, it is so close together that there is not room for lapping without increasing the thickness of some of the concrete members, which will in turn increase the tare weight of the hull. The weld by the electric resistance method can be made quite rapidly, and at small cost. It is not anticipated that welding any steel other than the main steel of the frames and possibly the main longitudinal steel will be required.

Mixing and Placing Concrete Important

Rich mortar mixtures will be used, and they must be carefully proportioned and mixed in order to insure the quality of concrete necessary. Special attention should be given to the selection of the mixer, as all mixers of common types will not thoroughly mix mortars. The concrete should not be transported from the mixer and deposited directly into the forms in continuous operation or in large batches, on account of the danger of not having it thoroughly worked into place about the reinforcing steel. For the present it is required that all concrete shall be shoveled into the forms in order to insure its deposit in small batches and its thorough working into place.

The actual placing of the concrete is a small item in the cost of construction of a ship, and therefore there should not be the incentive to rush the work as in ordinary building construction.

It is preferable to place the concrete as one continuous operation in order to avoid construction joints. This will require approximately three days (of 24 hours each) for a 3500-ton ship and six days for a 7500-ton ship. While it may appear difficult to work the concrete thoroughly around and through the reinforcing, no trouble is anticipated from this source. The rich mortar mixture proposed is quite fluid, even though it is not mixed to a wet consistency, and with a slight tapping of the forms it settles readily into place about the steel. A number of test panels have been made, and the results in all cases have been entirely satisfactory. It is very different to make a construction joint in a section in which is embedded a large quantity of steel. Most leakage troubles occur at construction joints. The uncertainty of the bond obtained at construction joints is also objectionable on account of the large shear stresses. Several mechanical methods of placing mortar and concrete have received consideration, but the results of investigations do not up to the present warrant their use.

Treatment of Hull Surfaces

It has been suggested by some that rough lumber be used for the outside forms, and a plaster coat be applied to the surface of the cast concrete. The application of such a plaster coat is not recommended, for the following reasons: The surface to be covered is very large, and the application of such a coat would have to be completed in a very short time. There is absolutely no way of assuring positively a perfect bond between the plaster coat and the concrete surface. The application of such a coat will increase the weight of the hull without compensating advantages.

Barnacles and sea vegetation will adhere to concrete in the same manner as they develop on steel and wood. It is therefore necessary that the bottom of the hull be coated with some antifouling paint. The same paints can be used as are now used on steel ships, except that special means must be taken to insure a thorough bond. Investigation of a number of paints and coatings of different types is now being made. It is quite probable for the present that a bituminous coating will be employed on the bottom of the Government ships.

There has been much discussion relative to the advantages and disadvantages of constructing the ship on ways which will permit of side-launching or end-launching. Ways built for side-launching permit of the construction of the ship on an even keel, thus making all the lines plumb. There have been very few accidents by sidewise launching of steel or wood ships, and it is believed the concrete ship can be safely launched somewhat earlier in this manner. In endwise launching the conditions of sagging or hogging depend upon the accurate positioning of the ways, and determination of the weight and conditions of buoyancy of the ship just before it leaves the ways. Slight settlement of any of the way piles may cause very serious hogging or sagging stresses. Two of the vessels being built by the Emergency Fleet Corporation will be launched endwise and the others will be launched sideways.

Certain of the equipment, such as the hawsepipe, stern frame, stern tube, etc., are cast into the concrete. The major portion of the equipment and all the machinery are secured to the concrete by anchor bolts. These must be accurately placed in the forms and completely detailed before the concrete is poured. Aside from the connections, the installation of machinery and equipment does not differ from the conditions met in either wood or steel ships. Wherever possible, through bolts rather than anchor bolts will be used. Under all deck machinery and fittings suitable waterproof gaskets should be placed so that there will be no leakage around the holding-down bolts. Too much attention cannot be given to the careful detailing of the fastenings and their exact location in the hull.

What Is the Durability of a Concrete Ship?

If durability is to be obtained, special attention must be given to many elements of the ship. The most serious problems is to provide means of adequately protecting the steel from corrosion. There is a large quantity of steel embedded in the concrete and much of it cannot be covered by more than ¾-in. of mortar. This of itself will not protect the concrete, particularly in the interior and in the upper portions of the hull. There are two means of allaying, if not wholly preventing, the corrosion of the steel. The steel may be galvanized or painted with some protecting medium which will not appreciably affect the bond, or the concrete may be coated with some thoroughly impervious

membrane which will prevent both air and water from reaching the steel. A large number of tests are being made, and it is quite possible both methods of protection will be tried. The results are promising and a satisfactory protection should be developed.

Another possibly disintegrating element which may have great importance is the effect of constant reversal of stress, as the ship alternately is subjected to hogging and sagging stresses in a heavy sea. Our allowable steel stresses are such as to cause the concrete to crack. There are few analogous structures on land to which we can refer for guidance on this subject and only experience can tell what may be expected. Reversal of stress tests are now under way.

No trouble from chemical disintegration is anticipated except as the hull may be seriously abraded.

The Concrete Ship Department estimates the life of the concrete ship without any special protection at several years, and known methods which can now be applied should extend the life several years longer. It believes adequate protection will be developed to insure reasonably permanent life to the concrete ship.

The use of direct current on a concrete ship should be avoided wherever possible, on account of the possibility of electrolysis from stray current. A very small leakage for an appreciable time, as demonstrated by the experiments of the Bureau of Standards, will cause a weakening of the mortar at the cathode, thus decreasing the bond strength. If the current leakage is large it may cause an oxidation of the steel at the anode, which will result in splitting and spalling of the concrete. The use of brass or bronze castings adjoining the concrete reinforcing should also receive consideration, on account of the possibility of local electrolytic action in the presence of the electrolyte.

With the quality of concrete being used no special provision will be needed to hold the heavier fuel oils. Investigations of various coating materials are being made with a view to their use as a lining if such is found desirable.

Sugar and certain vegetable oils, such as the cocoanut and peanut oil, will disintegrate the concrete if it is exposed for an appreciable length of time. If the ships are to be used in this class of trade, a protective paint coating should be applied to the inner surface of the hull.

The economy of the concrete ship cannot be determined until we have had experience over a term of years. The estimated cost of the concrete ship at the present time is approximately $125 per ton dead weight. The cost of a steel ship averages about $200 per ton, and that of a wood ship, $165 per ton dead weight.

If proper coatings can be developed to prevent deterioration, the concrete ship should be a competitor of the steel ship. With further experience it is believed the weight of the concrete can be very materially reduced, thus making the cargo capacity more nearly equal to that of the steel ship.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

How Laws for Relief of New York State Contractors Operate

Sir—During the past legislative session three laws were enacted which affect the New York State highway situation. The first of these laws consists of amendments to the highway law. These amendments provide for the acceptance of the completed portion of an unfinished contract and for the postponement until after the war of work on any portion upon which no work has been done. All portions of the contract upon which work has been begun must be completed unless proof can be shown that it is impossible to obtain some essential material.

The law was enacted with the support of the Highway Commission, and a statement which was given out concerning it contains the following:

"... It will be noted that any cancellation of contracts is in no way contemplated by which the contractor or the surety company is to be relieved in any degree from the contractural obligations now existing. ... We hope by its provisions to be able to present such inducements to the contractors and the surety companies as will encourage them to make a special effort to complete those portions of the roadway under traffic which are torn up and which now impede traffic. ... the state and any political subdivision ... are protected to the same extent as at present by the renewed assurance of the completion of the road at the original contract prices."

It is here clearly reiterated that by no device is the contractor to receive anything but payment at the pre-war prices for his work. The only possible financial relief to him is the paying of the retained percentage on a completed portion of the contract, and the relief from its maintenance. Anything further is merely conjectural, and is dependent upon a return to normal conditions in regard to wages and prices within a few months of the close of the war. This is so improbable as to need no discussion.

The second law is the so-called Walters law, which embraces all unfinished, pre-war, public contracts. It is a progressive piece of legislation and appears to be very fair in its provisions, both to the contractors and the public. In brief, it recognizes the existence of "emergency conditions" in connection with the execution of these contracts; provides for the cancellation of the contracts on the condition that the contractor file a stipulation agreeing, among other things, to complete the work or any part thereof at actual cost; and provides for the raising of any necessary funds. The contractor will be paid actual losses incurred since the United States went to war with Germany.

The bill also provides for the postponing, with the consent of the contractor, of any work deemed to be in conflict with the public interest or necessity, or

for the releasing of the contractor "subject to such conditions as may reasonably be imposed." It repeals any law or portion of a law "inconsistent" with its provisions.

It will be seen that this law and the amendments to the highway law were framed from opposite viewpoints of the ethical question involved; which is, whether or not the war and the consequent tremendous increase in costs is a legitimate "hazard" from which there should be no relief for a contractor other than a postponment of the removal of the "pound of flesh."

The question seems hardly debatable, for to maintain that war is a legitimate risk is to maintain that contractors should assume in all their bids that a war is to ensue, which is, of course, absurd; or else to maintain that the business of contracting is gambling, pure and simple, and that a contractor takes a gambler's chance from which he should never be relieved, which is equally absurd.

From the legal point of view the question has been more complex, but, as was pointed out by William B. King in *Engineering News-Record* of April 2, p. 727, there have been opinions, by former Attorney General Wickersham and others, and decisions by the Supreme Court of the United States, which support the point of view now recognized by the Walters law, and also by the third law above mentioned. This law authorizes the State Court of Claims to audit and determine any claims arising on state contracts by reason of increased costs due to statutory enactments subsequent to the signing of the contract in question. This is entirely just at any time and especially so at this time, as the war increases undoubtedly come within the scope of the bill.

State Highway Situation

In view of the passage of these acts a glance at the state highway situation is of interest. A memorandum recently filed by the Governor states:

"There are upwards of 200 contracts in force, aggregating $12,000,000 in amount and 900 miles in extent. About 600 miles of work remains to be done, amounting to about $7,300,000 . . ."

It would appear, therefore, that the contractors holding the contracts for this $7,300,000 worth of work may proceed to complete their contracts, and then file claims for the extraordinary increase in the cost of so doing; or they may ask for a cancellation of the contracts and proceed with the completion of the works at actual cost.

Undoubtedly, those contractors who have contracts nearly completed will choose the former method of procedure. Those who are not so far along will choose the latter, for the reason that it will be impossible for most of them to proceed without the relief offered in the Walters law. Bituminous material, which was bid on a basis of and bought for about 7c. just prior to the war, will not now be delivered at any price, the last quotations being nearly 20c. Crushed stone, that was 50c. to 70c. is now $1 and more. Freight rate and labor increases are well known, and any immediate relief from present prices is out of the question.

The opportunity is therefore offered for the completion at actual cost of such portions of this 600 miles of road as are deemed by the Highway Commission to be essential at this time, and for the releasing of the contractor on any portions which are deemed unessential.

Unfortunately, both for the state and the contractors, the Highway Commission has chosen not to accept this opportunity and has announced that it will take no action under the Walters law. It has notified these contractors that they must proceed with their contracts under the pre-war prices immediately, or accept the provisions of the amended highway law, which, as outlined above, merely provides for an extension of time in certain cases, and the acceptance of which would apparently prevent the contractor from ever obtaining any of the relief that is contemplated in the Walters law.

The ground on which the commission has assumed the authority to ignore entirely a law of this character is not entirely clear and has not been stated, other than that the act is "permissive" and does not compel any public agency to proceed under it. It is understood that numerous other public agencies are preparing to proceed under its provisions, having readily recognized the justice of affording the relief outlined.

From a practical road-building point of view, the attitude of the commission is even more difficult to understand, for it is not to be supposed that the contractors will accept, without every recourse to law, this interpretation of their rights. Neither is it to be supposed that the surety companies will do so. Meanwhile, the completion of the roads will be at a standstill, and the partially completed work will be suffering a tremendous loss.

DANA W. ROBBINS.

New York, N. Y.

Why Pavements Are Crowned

Sir—In your issue of May 9, p. 925, I notice a correspondent's inquiry under the heading, "Why Pavements are Crowned." In reply I have to say: With few exceptions, the only purpose of the crown is to cause a quick run-off of water to the gutters.

So far as traffic only is concerned, a flat level cross-section is preferable. However, the run-off from it would be slow, and, due to inevitable slight undulations in the paved surface, numerous shallow pools would be in evidence a large part of the time. This would make the surface slippery and unsightly.

A crown of 6 in. is enough for any street not more than 40 ft. wide between the curbs. A good cross-section is one with a vertical curve about 10 ft. long at the center of the street, with tangents from it to the gutters. However, the shedding of water and the avoidance of pools would be accomplished best by a vertical curve extending from curb to curb.

In side-hill locations it is often desirable to have one gutter about a foot higher than the other. In this case, a straight line from the upper gutter should fall to a tangential meeting with the curve near the center of the street. This cross-section throws all the water to the lower gutter. The same result may be accomplished by a vertical curve from curb to curb.

Albany, N. Y. RICHARD W. SHERMAN.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Life of Rubber Pump Valves Greatly Lengthened by Easy Repair

REPAIR of pump-valves in which the stem holes have become worn by friction can be easily accomplished by bushing them with plugs cut from old valves, says Timothy Ryan in *Coal Age*. Valves thus worn cause a great deal of trouble and replacing them is no small item of expense.

It is not uncommon for practically new valves to develop such large holes that the efficiency of the pump is much reduced by the escape of water. To overcome this, the valve is taken out and the hole punched somewhat larger than desired. A plug cut from a discarded valve is then pressed into the hole with rubber cement. This leaves a blank valve in which a new hole of any desired size can be punched. When this bushing becomes worn, it is easy to remove it and insert another. It is possible to bush valves to fit worn spindles in this way, and keep the spindles in service for a long time after they would ordinarily be discarded.

The above method of repair has been used, says Mr. Ryan, for several months with excellent results.

It's stimulating to *your* think-tank to see how the other fellow has been using *his* head.

Even if you can't apply the thing he tells about directly, just to know he has pulled a good one puts you on your toes.

You say, "———, I can beat that."

Do it—and then tell us all about it in

HINTS FOR THE CONTRACTOR

Haul Eighty-One-Foot Girders Two Miles on Five-Ton Truck and Trailer

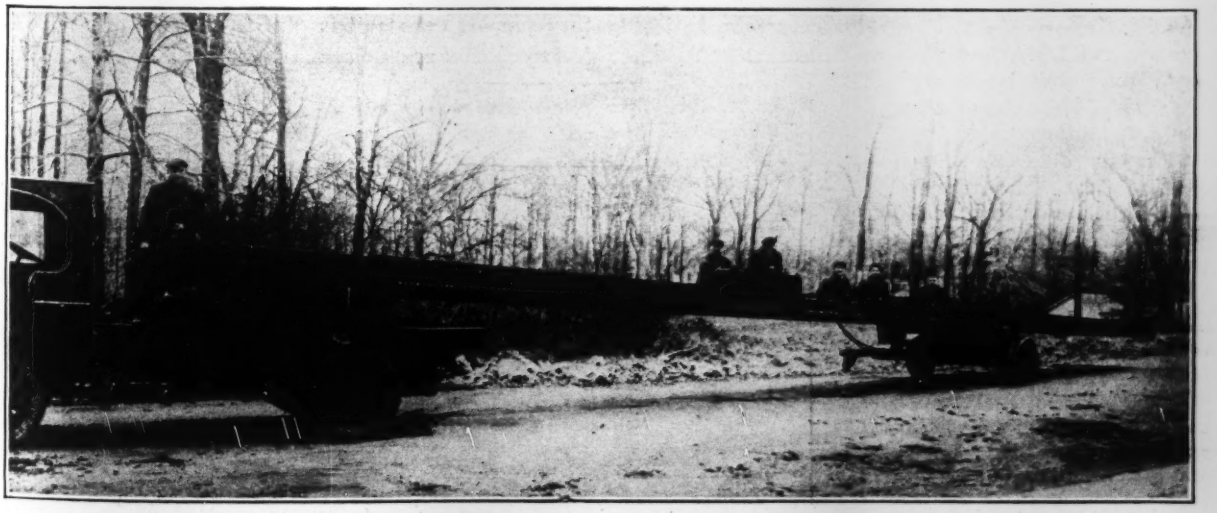
A PAIR of 21-ton girders 81½ ft. long were recently transported, in the manner shown in the photograph, from the nearest railroad siding to the Eastman Street bridge recently built over the Rahway River at Cranford, N. J. The forward end of each girder in turn was wired on a pivoted bolster centered over the rear wheels of a 5-ton Garford truck, while the rear of the girder was carried on a heavy low truck set one-third of the way from the back end. Both girders were hauled without difficulty, the 2-mile trip being made over good roads. At the freight yard where they were unloaded, however, the ground was soft, and it was necessary to make a roadway of 6-in. plank from the cars to the edge of the nearest pavement.

The hauling was done under the direction of R. R. Sprague, for the Dover Boiler works which furnished the steel for the erection of the bridge.

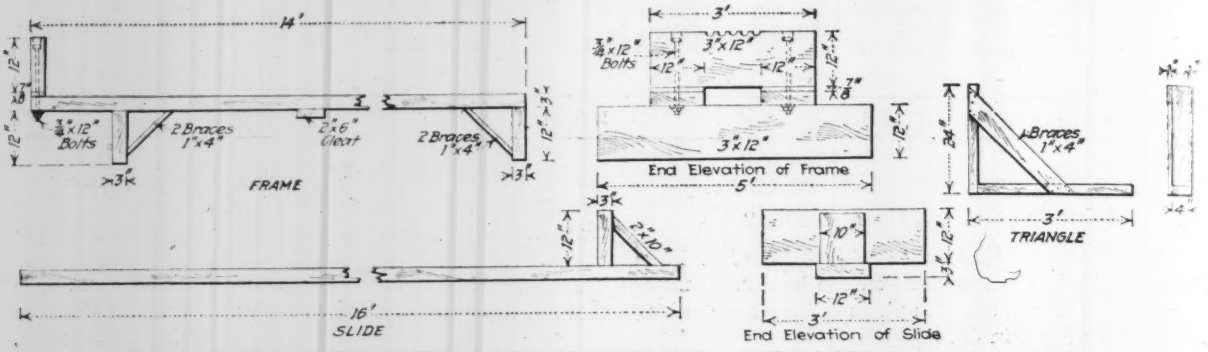
Round Trestle Timbers Sawed in Big Miter Box on Car

REPAIRS to a coal dock trestle, in which rotted pile tops were replaced with mine timber, were recently made by sawing off these irregular posts in a device which acted as a big miter box. The work was described in *Engineering and Mining Journal* for July 6 by L. D. Davenport, chief engineer of the Oliver Iron Mining Co., Hibbing, Minn.

The majority of the bents were of square timber, resting on a pile foundation. The piles were badly rotted at the surface of the ground, while the square timber was in good condition. The repair work con-



TWENTY-ONE-TON GIRDER CARRIED BY BOLSTER ON REAR OF TRUCK



CROOKED MINE TIMBER SAWED TO EXACT LEVEL FOR TRESTLE REPAIR IN BIG MITER BOX

sisted of holding up the square timber bents with false work and cutting off the piles 12 in. below the surface of the ground, building forms, pouring concrete mud sills and retimbering. The bents were taken alternately, as the trestle was in daily use. When the concrete had

ALTERNATE BENTS WERE REPLACED

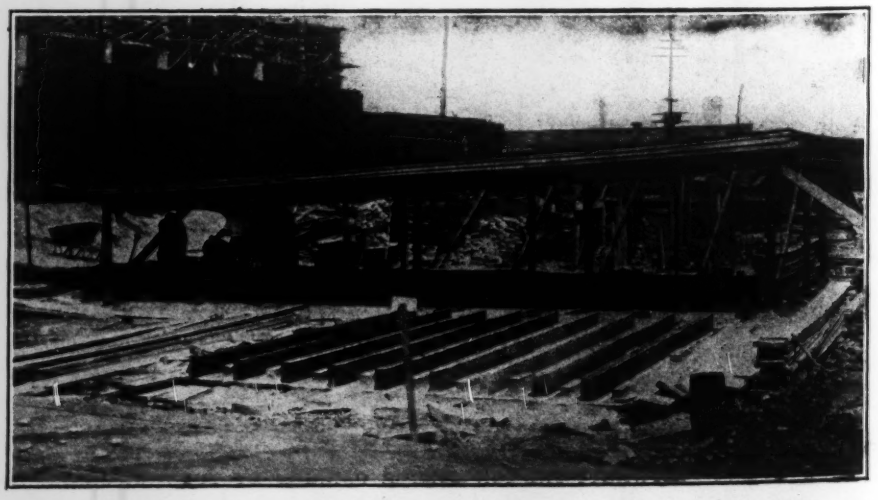
set for 10 days, round timber posts were placed from the concrete sills up to the square timber sills. There were five posts in each bent. The three inside posts were plumb, and the two outside posts were battered 1 in. to the foot. The false bents were also made with five posts. The round timber used was mining timber from 10 to 16 in. diameter. Much of it was far from straight.

To facilitate cutting off the posts, either square or with the proper bevel, the device shown in the sketch was built and in effect is a large size miter box. In operation, a ¾-in. hole is bored in the center of each end of the post to be cut off and a short pin of ¾-in. round steel placed in each hole, so that the steel projects about 6 in. The post is then put on the device with the pins resting on the notch in the slide at one end and on the center notch in the frame at the other end. The two triangles are then tacked on either side of the post, square with the frame, where they serve as a guide for the crosscut saw. One end of the post is then sawed two-thirds of the way through, and the triangles are moved to the other end, where a second cut is made. The post is then wedged up at each end, the pins are removed and the cuts finished.

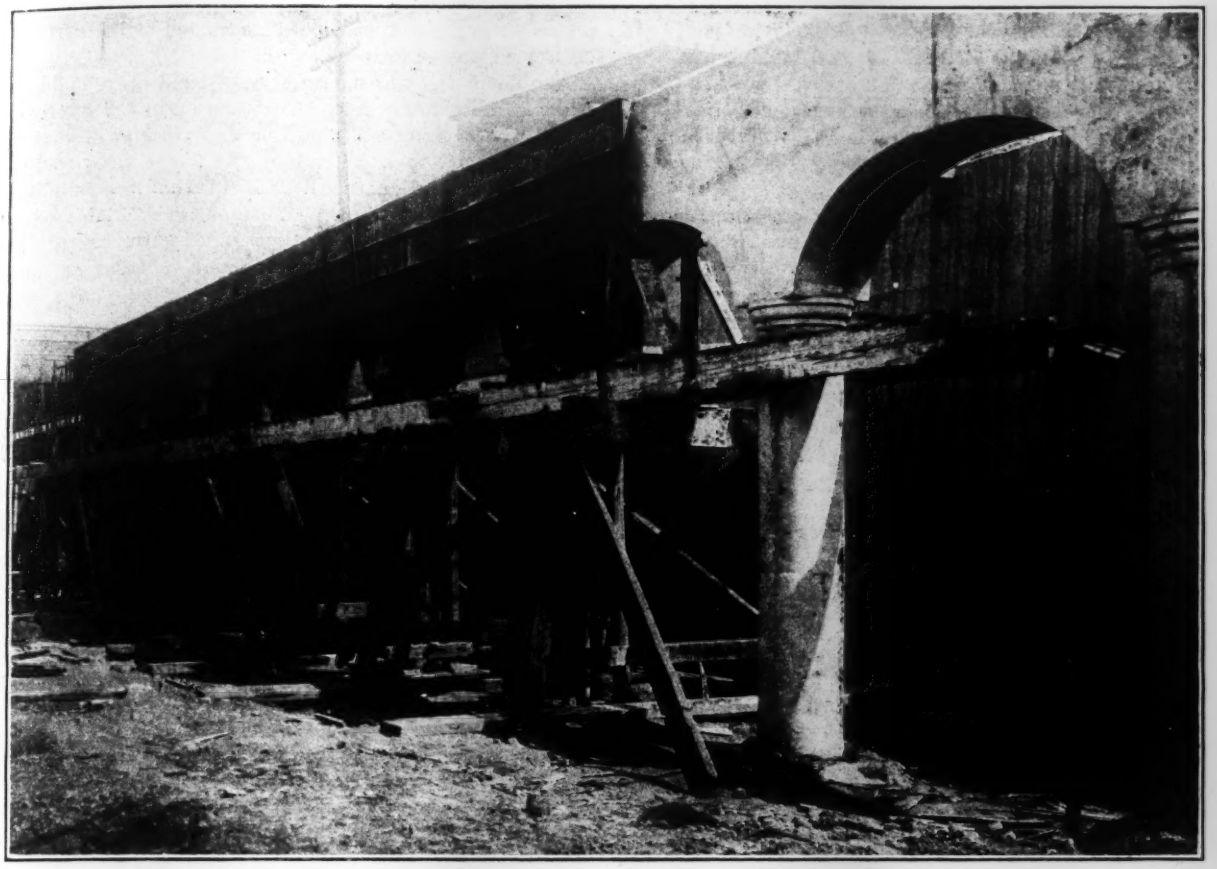
When a batter post is to be cut, one pin is placed in the center notch of the slide and the other in one of the outer notches in the frame, according to the length of the post (before it is cut) and the batter desired. For example, with a 9-ft. post and a desired batter of 1 in. to the foot, the pin at the frame end will be set 9 in. from the center notch. This device is easily made, insures accurate cutting and saves considerable time, especially in cases when the timber is crooked.

Miniature Blockyard Furnishes Reinforcing Supports

A CONCRETE-BLOCK casting plant on the job provides the precast blocks for supporting during concreting the 29 acres of floor-slab reinforcement employed in constructing the new quartermaster's depot at Chicago. The blocks are 4 x 4 x 6 in. and 110,000 of them were required. Set on the floor form lagging they support the slab bars during pouring and become



CONCRETE BLOCKS TO SUPPORT REINFORCEMENT CAST IN THIS YARD



WOOD FRAME STAGING USED OVER AND OVER CARRIES FORMS FOR VIADUCT

an integral part of the concreted slab. The picture shows the casting yard and the curing shed. The forms for molding the blocks consist of 2 x 6-in. planks 12 ft. long, separated by steel plate dividers 6½ in. long and 4 in. high. Saw cut grooves ¼ in. deep at intervals of 4 in. in the sides of the planks hold the ends of the dividers. Clamps keep the plank sides from spreading. The forms are filled with the same mixture as is used in the floor slabs. The cast blocks set for 36 hours, when the side planks are knocked down and the divider plates are picked out, and both planks and plates are set up for a new batch of blocks. The contractors for the depot building are the E. W. Sproul Co., of Chicago.

Light Frame Bents Hasten Form Shifting

THE staging illustrated above reduced by one-fourth the time of shifting steel forms from section to section of column and cloister girder piers employed in recent Chicago track-elevation work. About 60 ft. of steel form is employed to mold long lines of pier columns and girders, requiring several shifts of forms. The staging, like the forms, is used over and over. It consists of framed bents and two lines of stringer timbers, with enough spare boards for bracing the bents together. In practice the bents are set up and leveled, and then the bracing is nailed in place as the foreman decides it to be necessary. Then the lines of stringers are placed and spliced by nailed battens. The column capital and girder forms are then put in place on the stringers. Finally the shaft forms for the columns are erected. Two facts will be noted; first, the staging carries the whole load of the girder forms and the shaft forms bear none of the load from above; second, the leveling is all done in erecting the staging so that the form erectors have only to assemble and set the steel molds in place. In dismantling the forms, the staging units are set free by merely knocking out the braces and battens, after which they are carried ahead and set up again.

Trained Dogs Guard Equipment of St. Paul Contractor

THE GEORGE J. GRANT CO., St. Paul, Minn., contractors, has been using Airedale dogs, specially trained, for watching plant out on their various jobs, according to the Bulletin of the American Hoist & Derrick Co. It is said that the experiment has been very successful. The dogs are tied by long, light chains to trolley wires so placed that it is not possible for a prowler to reach any article of value without encroaching on the beat of one of these sentinels.

The instruction of an Airedale for watch dog duty of this kind is begun when the puppy is about six months old. It does not take these intelligent dogs more than a month to learn the "business," and they are at their prime when they reach the age of three

years. This does not mean, however, that they are not useful for several years longer. It is said that since the idea of using these dogs to guard plant has been tried out much pilfering of small articles, such as picks, shovels, wheelbarrows, boiler fittings, etc., has been stopped. One harrowing experience with these very earnest watchmen is a great plenty for the average petty thief.

The only drawback about these dog guardians is that their method is to "shoot first and investigate afterwards." They make slight distinction between friend or foe when they find a prowler, and in more than one instance workmen who had gone back to the job after some article which they had forgotten have been fiercely attacked by the watch dogs.

One watchman with several well-trained dog assistants can take care of a large quantity of equipment and the expense would be much less than if several men had to be employed.

Steel Pipe Erected from Derrick on Sections Already Built

A READILY movable small derrick mounted on a steel pipe line already built was used to erect new sections at the Trenton Falls development of the Utica Gas & Electric Co.'s new plant in the Adirondacks.

The 12-ft. line is composed of plates from $\frac{9}{16}$ to $\frac{11}{16}$ in. thick, in sections or rings 7½ ft. long, in general. They were erected principally by the derrick shown, having one stiffleg and being side guyed with light wire rope tackles to nearby trees, etc. The foot block was arranged to bolt to open holes in a circumferential seam, while the foot of the stiffleg was provided with a heavy bent strap, with several holes in the horizontal leg. By bolting through the proper holes in this strap to the open holes of the second seam back of the stiffleg the mast could be adjusted to the vertical on any of the grades met with.

TWELVE-FOOT PIPE HANDLED FROM SMALL DERRICK

The boom fall was operated by a hand crab, and the main fall also for a time. Later the main fall line was carried back along the pipe line and through a snatch block attached to a column of the surge tank to the electric hoisting engine housed in the low building shown just to the right of the pipe line. Plates were dragged some distance at times and were erected by this rig at a maximum rate of three complete rings per nine-hour day. Five rings could be erected at one setting of the derrick.

Yukon Mining Methods Keep Hydraulic Fill Soft

HYDRAULIC fill, made in winter at the Junction Dam, near Wellston, Mich., was kept thawed by steam jet outfits similar to those used by Alaskan placer miners. From November to March, inclusive, the fill was made at temperatures generally well below freezing and frequently well below zero. At times the thermometer registered —30°. When a reasonable amount of attention was given very little ice was deposited in the embankment, and there was no tendency for the sluiced material to freeze as long as the water was allowed to run over the surface. When the temperature remained below 15° F. for more than a few hours, sluicing was stopped. When it was started anew the embankment surfaces under construction were cleared of snow and ice. In some cases, where it was impossible to make a continuous fill, the ground froze, and thawing was necessary before sluicing was resumed. Steam jet outfits performed the thawing satisfactorily. Live steam at a pressure of 10 to 30 lb. was used. A steam main or header was run to the area to be thawed. This header had numerous 1-in. hose branches connected to ¾-in. pipes, 6 to 8 ft. long. Under the action of their own steam these pipes could be jetted down into the soil to effect a mud seal around the ends. Standing vertical, the pipes were left to feed down by the jet action and their own weight. Some steam escaped through the mud seal, but by the attention of one or two men with shovels the loss of steam was kept small. In frozen sand the jets would be spaced about 6 ft. apart in both directions and allowed to remain in one place from four to six hours. During this time the sand would be thawed for a depth of 3 to 5 ft. The Junction Dam was built for the Consumers' Power Co. by the Fargo Engineering Co., Jackson, Mich.

Municipal Franchise Rates Subject to State Control

Municipal franchises in New Jersey are not inviolable contracts between cities and utility companies, but instead are conditional grants subject to the sovereign power of the state, according to a decision handed down by the State Court of Errors and Appeals on June 17. Accordingly, the New Jersey Public Utility Commission may order changes in municipal utility rates, even though these were fixed in franchises. The decision was rendered in Atlantic Coast Electric Railway Co. vs. the Public Utility Commission. A directly contrary opinion was recently handed down by the New York Court of Appeals in the Rochester 6c fare case.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

New York Road Builders Lose Test Case

Hewitt, Not Walters, Law Applies to Highway Contracts, Under Court Decision

Application for a peremptory writ of mandamus, compelling the State Commissioner of Highways to cancel all road contracts not completed when war was declared, was denied by Justice Chester in a special term of the state supreme court at Albany, N. Y. The application was made by the New York State Roadbuilders' Association, using as a test case a state road contract in the village of Rosendale, Ulster County, N. Y. The decision is important because it affects practically every road contract in the state.

Two laws were enacted by the last session of the state legislature relating to state highway contracts. The first, known as the Hewitt bill, provided for the acceptance of completed portions of unfinished contracts, the cancellation of contracts and the postponement of the remainder until after the war, postponement being contingent upon proof of inability to obtain essential materials. It was also provided that contracts upon which work had not begun could be postponed until after the war. The second, known as the Walters law, embraces all unfinished pre-war public contracts and provides for their cancellation provided the contractor will agree to complete the work or any part thereof at the actual cost, the contractor to be paid for actual losses incurred since the United States entered the war. It also provides for the postponing of all work, with the contractor's consent, or the cancellation of all work which conflicts with the public interest.

The Highway Department elected to operate under the Hewitt law, while the contractors wish to utilize the greater relief offered by the Walters law. The test case was instituted to compel the department to follow the provisions of the Walters law.

The attorneys supporting the application argued that the Walters law made it mandatory for the Commissioner of Highways to cancel all state road contracts which were not completed at the time war was declared. Deputy Attorney General Rose contended that the law gave discretionary power to the Commission of Highways. In denying the application Justice Chester says that in his opinion the words "empower and authorize" in the law are not mandatory but confer the power of discretion. If this opinion is finally held to be correct, the various departments of the state government can use whichever law they see fit.

No Concrete Ships Permitted for Private Account

Concrete ships for private account can not be built at present. Such construction is forbidden, under a ruling of the United States Shipping Board that reads as follows: "Owing to the large increase in our program by reason of the demands of the War Department and the necessity of expanding existing boiler and engine facilities, the board deems it unwise to permit the construction of any concrete ships for private account, and hereby announces as its policy that it will grant no permits for such construction until facilities have been expanded to meet the needs." Control of construction is effected through control of priority orders for materials which are withheld from private shipyards.

In regard to the possible private construction of concrete barges or towboats a recent letter from Howard Coonley, vice-president of the Emergency Fleet Corporation, says: "In the resolution a reference is made distinctly to concrete vessels, and the question involved is one of machinery and equipment. The Shipping Board has not made a hard and fast ruling in connection with the construction of concrete barges for private account or for other ships that are not self-propelled. In any case involving the question of the construction of this class of ship for private account, the matter will be considered on its own merits, and a permit may be given by the Shipping Board in this connection."

Appeal for Funds to Defend Septic Tank Suits

An appeal for funds to enable the National Septic Process Protective League to continue helping the city of Shelbyville, Ky., defend the patent infringement suit brought against it by the Cameron Septic Tank Co. is made in a circular being distributed by Frank G. Pierce, Marshalltown, Ia., secretary-treasurer of the league. An outline of the case, which is about to be tried on its merits, is given in the circular. The appeal is addressed to all users of septic tanks in operation prior to Oct. 16, 1916.

Bill for Government Licensing of Water Power

The special House committee on water power development reported a water power licensing bill to the House modeled, in general, on the so-called administration bill, which was drawn by direction of the Secretaries of War, Interior and Agriculture, and introduced in Congress some months ago.

John Purroy Mitchel

As Mayor of New York He Relied On Expert Advice, Say Engineers of His Administration

[Maj. John Purroy Mitchel, killed last week in a flying accident, enjoyed as administrator of the largest city in the world during the period when the greatest municipal engineering enterprises ever undertaken were under way, the reputation of being one of the few great public executives who appreciated the value of engineering advice, and who consistently sought and acted on such advice. *Engineering News-Record* has asked two of the engineers most closely connected with Major Mitchel's administration as mayor of New York for appreciations of his work, which follow.—EDITOR.]

J. Waldo Smith, chief engineer, Board of Water Supply, New York City, writes:

"The tragic death of Maj. John Purroy Mitchel, former mayor of New York City, has brought to me not only a deep sense of personal grief and loss, but of the loss to the country and the world by the untimely cutting off of a career so bright with promise.

"The interest in him as chief executive of New York City was nation-wide, and not limited, as is usually the case, to the city and the state. The splendid way in which he upheld the dignity of the city during the visits of the representatives of the foreign governments made us all proud that we had such a man to represent the city on so important an occasion and called forth from those distinguished delegates the highest praise; from that time it could be said that his fame was international.

"Throughout his long experience in public affairs in the city he was fearless in upholding truth and right, and when he was convinced that a certain line of action should be taken he absolutely ignored the effect which his advocacy of a movement or action might have on his political career, or his own personal interests, thus demonstrating the highest degree of courage in a public official. In the conduct of the city's affairs, and especially in connection with the many improvements undertaken during his administration, he was a firm believer in the value of the expert advice of technical men, particularly that of the engineers, and he had the highest admiration for the work which was being done by them in the upbuilding of the city. He freely employed as advisers experts in work pertaining to education, engineering and all branches of science and industry. From the time of its inauguration by Mayor McClellan, he had a deep interest in the

work of the additional water supply, which was continued until the time of his death, and no small part of the credit for its successful completion is due to his consistent and persistent coöperation and help as well as his singular ability to grasp the broad principles of the recommendations made and and to state the case simply, clearly and forcibly.

"His patriotism was of the highest order and because of his keen interest in preparedness and advocacy of universal military training at a time when this principle was looked on with great disfavor by those in high places, he gained the cordial respect and interest of the engineers throughout the country, who were among the first to see the necessity for preparedness.

"He accomplished more in his short life than others who have had the good fortune to live the full allotted span of years, and of him it may truly be said that we will never see his like again."

From Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, comes the following: "Almost the entire period of Mr. Mitchel's life was devoted to municipal administration. Such work was regarded by him as a science and in this science he was a recognized expert. His alertness of mind and his unusual capacity for work enabled him to accomplish much in a short time, but he continually made use of and depended upon the advice of others with special training and experience in the various fields of municipal activity.

"The fact that the City of New York should have availed itself of the unusual experience and qualifications of Mr. Mitchel by making him its chief executive, may justify the belief that municipal administration will some day be considered a profession, the highest rank in which will be within the reach of its most capable and industrious students.

"No better example could be given of the result of whole-hearted devotion to such a profession as a career than the life of John Purroy Mitchel."

Tunnel Explosion Attributed to Marsh Gas

Five workmen were killed outright and another was seriously injured in an explosion that occurred June 26 in the tunnel being driven for the East Bay Water Co., Oakland, Cal., by Bates & Borland, contractors. The heading had been advanced about 1500 ft. and some previous difficulty with gas had been experienced. The five men killed were working at the heading; the sixth man, operating a storage battery locomotive, was some distance from the heading. It is believed that a spark caused by the striking of a pick on rock may have ignited the gas. The explosion caused a cave-in which prevented rescuers from bringing out the bodies until the débris had been excavated.

A Brigadier at Thirty-Four

Memories of Civil War times, when boys in the twenties became generals, were aroused by the latest list of promotions approved by the President, which contains the elevation of Col. John N. Hodges, U. S. N. A., to the rank of brigadier general. General Hodges, a brigadier at 34, is the youngest general officer in the United States Army. He was graduated from West Point at the head of his class in 1905 and immediately entered the Corps of Engineers, serving first in the Philippines and later on station in the United States. He was a captain when the

BRIGADIER GENERAL HODGES

United States declared war. He went to France with the earliest railway regiments last summer and has served continuously with the 6th Engineers since that time, taking command of the regiment a few months ago. At the famous retreat from St. Quentin, he headed several companies of his regiment who joined General Carey in the formation of a hasty army which stopped the gap between the British and French lines and prevented the further advance of the German army toward Paris. For gallantry in that action he has been decorated by the English, the French and the American Governments.

Jersey City Wants Bids on 72-In. Steel Pipe

Bids on supplying 34,590 ft. of 72-in. riveted steel pipe to duplicate its gravity water-supply conduit from the Boonton reservoir to the Watchung tunnel are wanted on July 16 by Jersey City. For 34,125 ft. the plates must be 5/16 in. and for 465 ft.. 7/16 in. thick. The new conduit is being rushed, to guard against a repetition of the water shortage of last winter's cold spell. M. I. Fagen, City Hall, Jersey City, is director and Charles A. Van Keuren is chief engineer of streets and public improvements. Clyde Potts, 30 Church St., New York City, is consulting engineer.

Mr. Fagen informs *Engineering News-Record* that separate bids for laying the pipe will soon be asked. He adds that "this is the initial experience of Jersey City in subdividing large public works contracts" so as to get "bids from manufacturers direct." In 1919, Mr. Fagen states, bids will be taken for enlarging the concrete portions of the water-supply conduit from 70,000,000 to 90,000,000 gal. a day. Still later, the reservoir storage capacity will be increased in like amount. The entire program will increase the water-supply possibilities of Jersey City from its present limit of 50,000,000 gal. to 90,000,000 gal. a day.

Illinois Rejects All Highway Bids Taken June 26-28

All bids taken by the division of highways, Department of Public Works and Buildings, State of Illinois, on June 26-28 inclusive, have been rejected as too high. In view of this fact, it is thought that no awards will be made and that the work will be put off until after the war. The roads in question include nine sections of the Lincoln Highway, six sections of the Dixie Highway, and six sections of various county highways. For concrete highway 18 ft. wide and 7 in. thick the low bids ranged from $19,677 to $26,437 per mile, the average of low bids being $22,008 per mile; for concrete highway 16 ft. wide and 7 in. thick the low bids ranged from $14,495 to $25,215 per mile, the average being $19,304; two bids were received upon 4-in. brick laid upon a 4½-in. concrete base at $25,836 and $24,788 per mile.

District Directors and Federal Managers for West

F. G. Pettibone, formerly vice-president and general manager of the Gulf, Colorado & Santa Fé Ry., has been appointed district director of the railroad administration for the state of Texas, Southwestern regional district, and William Sproule, president of the Southern Pacific Co., has been made district director of that part of the Central Western regional district west of Ogden, Utah; Albuquerque, N. M., and El Paso, Texas.

W. B. Storey, recently vice-president of the Atchison, Topeka & Santa Fé system, has been made Federal manager of that system. Mr. Storey is an engineer. He was chief engineer of the Santa Fé system from 1906 to 1909, and is a past president of the American Railway Engineering Association. E. E. Calvin, president of the Union Pacific R.R., has been made Federal manager. W. R. Scott, vice-president and general manager of the Pacific system of the Southern Pacific Co., has been made Federal manager.

J. E. Gorman, recently president of the Chicago, Rock Island & Pacific Ry., and A. Robertson, vice-president of the Missouri Pacific system, have been made Federal managers of those re-

spective systems. J. A. Edson, president of the Kansas City Southern, has been made Federal manager of that and several smaller roads. L. Kramer is made Federal manager of the St. Louis-San Francisco and the Missouri, Kansas & Texas systems north of Texas, excluding the former's Memphis-Birmingham line.

Three Federal managers receive jurisdiction over most of the railroads in Texas. J. L. Lancaster, receiver of the Texas & Pacific, has that system, the Texas lines of the St. Louis Southwestern, and several other roads. J. S. Pyeatt has the Gulf, Colorado & Santa Fé, the St. Louis-San Francisco, the Missouri, Kansas & Texas and other lines. W. B. Scott has the Southern Pacific lines and the San Antonio & Aransas Pass.

Congress Gets Bill for New York-Jersey Highway Tunnel

A bill providing for the payment by the Federal Government of half the cost of the proposed highway tunnel between New York City and New Jersey under the Hudson River, upon plans approved by Maj. Gen. George W. Goethals, was introduced a short time ago simultaneously in the Senate and House of Representatives by Senator Calder of New York, and Representative Eagan of New Jersey. The bill appropriates $6,000,000 on condition that the States of New York and New Jersey shall each appropriate the sum of $3,000,000.

New Jersey has already committed itself to the project and a bill was pending in the New York legislature when that body adjourned. Favorable action is expected upon the reassembling of the legislature. The authors of the bill say that the tunnel, which will be used for vehicular traffic, will not cost more than $12,000,000, and this amount, they say, is about one-fourth of what it would cost to build a bridge between the two states. Plans for the tunnel have been made by General Goethals, and other engineers have favorably passed upon them.

District Buys Reduction Works

Since July 1 the garbage-reduction plant of the Washington Fertilizer Co., at Cherry Hall, Va., has been operated by the District of Columbia, which has taken over the works at a price of $85,000. It is expected that a percolator will be added. The works will be operated under the direction of J. W. Paxton, superintendent of the street cleaning department of the district.

Barge Canal Is Given Favorable Freight Differential

The United States railroad administration on June 25 put into effect a freight differential in favor of the New York State Barge Canal over the competing railroads. On that date freight rates on the railways were raised 25%, but at the same time differentials were established which make the canal rates about the same or slightly higher than they were on the railways before the increase. These differentials vary from 10c. to 3c. per 100 lb. for different classes of freight varying in cost per 100 lb. from 60 to 20c., respectively, on the New York-Buffalo rate.

When the Government took over the canal it established rates somewhat higher than those already in force by the private carriers, which were much lower than the present standard rates.

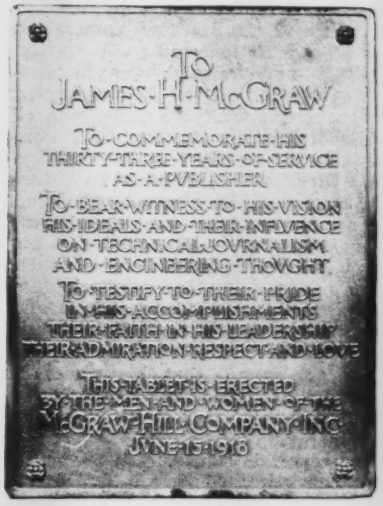
James H. McGraw Presented With Tablet

Employees and Associates Commemorate His Third-of-a-Century Service as Technical Publisher

James H. McGraw, president of the McGraw-Hill Co., Inc., publishers of *Engineering News-Record*, who has completed a third of a century as a publisher of technical journals, was the guest of employees of the company and associates in the publishing industry at a recent meeting held to commemorate the event.

The employees of the company presented Mr. McGraw with a bronze tablet, which will be mounted in the building at Tenth Ave. and Thirty-sixth St., New York. A photograph of the tablet is reproduced herewith.

At a dinner given to Mr. McGraw by associates in the publishing business speakers gave reminiscences of early days and described the growth in influence and power of the engineering press. Mr. McGraw in responding touched on the large opportunities for service and the serious responsibilities of the publishers in these times.



Rural Motor Express Suggestion Well Received and Applied

The suggestion of the highways transport committee of the Council of National Defense that motor trucks be utilized to facilitate the movement of perishable food products to shipping and consuming centers, has been well received, and new applications of the principle are being developed, according to the Committee on Public Information. The purpose of this service is to relieve the farmers, as far as possible, from the labor of hauling their produce to market and bringing back the necessary merchandise and tools for carrying on their business. This is considered a very important matter, in view of the labor shortage.

In the vicinity of Washintgon an arrangement has been made whereby loads of fruit and vegetable for canning will be delivered from the producers to canning club centers in the city. This produce will be sold wholesale to members of these clubs for canning in their homes. In this manner a more direct system of marketing has been devised which, it is expected, will not only assure an increase in home canning of perishable foods and vegetables, but will also induce the farmers to keep up production, which they were inclined to decrease, on account of the difficulty of hauling the produce to market. The system also relieves the local freight and express traffic, now much congested, of these extra loads. In sections where there are no short-line railroads, rural motor express is especially convenient. State food administrators in many sections report that this innovation will be very valuable, as there are many outlying districts which cannot be served by the railroads, but which can produce foodstuffs.

Surveys conducted by the Highway Transport Committee show that trucks can be made available for operation in fleets in the important fruit-growing sections, to supplement the usual shipments of food by rail in the rush period of the harvest. All that is necessary is to mobilize and use continuously large numbers of trucks owned by farmers, and used at present only a few days per week. Many permanent rural motor express routes are also being established in communities where there is need of regular daily service for farmers to and from the market, and several of the state food administrators are assisting in this work by discovering districts where such highway transport is needed.

Russian Utilities Nationalized

Water-works, gas-works, canals and railways in Russia are to be nationalized by decree of the Soviet Council, according to a recent cablegram. Nationalization will also extend to coal, iron, copper, silver, lead, salt and nearly all gold mines; metallurgical, textile, electrical, explosives, wood, tobacco, rubber, glass, pottery, leather and steam mill industries.

Unfavorable Commission Report on "Free Energy" Engine

The special commission appointed by resolution of Congress to investigate the invention for utilizing "free energy" known as "Garabed" has rendered an

unfavorable report on the invention to Secretary of the Interior Lane. The report reads as follows:

"We, the undersigned, who are members of the commission duly appointed in accordance with the provisions of Public Resolution No. 21, 65th Congress, hereby certify that Mr. Garabed T. K. Giragossian showed us on Saturday, June 29, 1918, a model embodying the principles of his invention known as the "Garabed." We found that the model was not in shape to run or develop power. The inventor admitted that he had no working machine and that he was merely explaining principles. We do not believe that his principles are sound, that his device is operative, or that it can result in the practical development or utilization of free energy."

The report is signed by the commission, consisting of James A. Moyer, director of the Massachusetts State Board of Education, and Edward F. Miller, M. deKay Thompson, Edwin B. Wilson and Charles L. Norton, all of the Massachusetts Institute of Technology.

Federal Health Control Unified

All sanitary or public health activities carried on by the executive branch of the Government "especially created for or concerned in the prosecution of the existing war" are to be "exercised under the control of the Secretary of the Treasury" hereafter, according to an order by President Wilson dated July 1, under Congressional authority approved May 28. Excluded from the order are the Surgeons General of the Army and Navy, the Provost Marshal General in the performance of military health functions, and the Bureau of Labor Statistics, as regards investigations of vocational diseases, shop sanitation, and hygiene. It is understood that the administration of this order falls on the United States Public Health Service. That organization has not yet made any public statement interpreting the exact effect of the order.

Additional Water-Supply Proposed for District

Congress has before it a joint resolution directing the Secretary of War to appoint a commission to report on available sources of water-supply for the District of Columbia. Three of the commissioners would be selected from the Corps of Engineers, U. S. A., one from the Washington Suburban Sanitary Commission, and one from the Engineering Department of the District of Columbia. The investigation would cover available sources of water-supply from rivers and streams near Washington, the additional supply to be sufficient for the present needs of not only the District of Columbia, but also the territory within the jurisdiction of the Washington Suburban Sanitary Commission, and the Federal military reservations contiguous to the District of Columbia. The resolution carries an appropriation of $15,000. The report would be made to the Secretary of War and submitted by him to Congress with recommendations. In this connection attention may be directed to a report on the possible use of Patuxent, Middle Patuxent and Little Patuxent Rivers of Maryland as a possible source of additional water-supply for the District of Columbia and as affording also a supply for the Washington surburban districts. This report was made quite recently by Robert B. Morse, chief engineer of the district and of the Maryland State Board of Health. The report indicates that a daily supply of at least 160,000,000 gal. would be delivered from these sources. The supply contemplated by Mr. Morse would be filtered and would serve the whole of the District of Columbia without pumping, whereas now the water has to be pumped for a high-service area.

ENGINEERING SOCIETIES

The Colorado Association of Members of the American Society of Civil Engineers elected the following officers at the recent annual meeting: President, L. R. Hinman; vice-president, E. C. Jansen; secretary-treasurer, A. M. Miller.

The Binghamton Engineering Society, Binghamton, N. Y., was addressed at its meeting June 27 by F. L. Wheaton, division engineer, Delaware, Lackawanna & Western R.R., who spoke on the design and construction of the New Jersey and Pennsylvania cut-offs of the Lackawanna.

The North Carolina Society of Civil Engineers adopted a constitution and by-laws at the recent convention held at Greensboro. The next meeting of the society will be held next January at Raleigh; the board of directors will report then on affiliation with the American Association of Engineers.

The Cleveland Engineering Society elected the following officers at the recent meeting of the old and new boards of directors: President, E. B. Thomas; vice-president, R. I. Clegg; secretary, A. F. Blaser; treasurer, C. E. Drayer; librarian, E. S. Carman.

The Northwestern Society of Highway Engineers, the Portland Association of Members of the American Society of Civil Engineers and the Oregon Society of Engineers will hold a joint meeting in the Public Library Building, Portland, July 13, in connection with the regular meeting of the first-named society. Herbert Nunn, president of the Northwestern Society of Highway Engineers, will speak on the importance of coöperation between highway and other civil engineers. R. H. Thomson, of Seattle, will address the meeting on the enactment of legislation for the registration of professional engineers. The advisability of establishing an engineers' club in Portland will be discussed by Orin E. Stanley, president of the Oregon Society of Engineers. R. M. Gillis, district engineer, State of Washington Highway Department, will speak on the advisability of changing the title of county surveyor to county engineer, coördinating the duties and salaries.

PERSONAL NOTES

WILLIAM C. PICKERSGILL has resigned as designing engineer, water supply board, Providence, R. I., to enter the service of the division of shipyard plants of the United States Shipping Board.

J. M. HAMMOND, formerly assistant to the chief engineer, Kansas City Terminal Railway Co., has been commissioned as captain in the construction division of the Quartermaster Corps, and assigned to duty at Washington.

B. F. CRESSON, JR., consulting engineer for the State Board of Commerce and Navigation, Trenton, N. J., has been appointed chief engineer to the New York and New Jersey Port and Harbor Commission.

ROY S. BONSIB, of the safety, welfare and employment department of the United States Metal Refining Co., Chicago, has been appointed safety engineer, District No. 7, Emergency Fleet Corporation, including California and a part of Oregon. His duties will consist of accident prevention work in the shipyards.

J. M. R. FAIRBAIRN, assistant chief engineer of the Canadian Pacific Ry., has been appointed chief engineer, succeeding J. G. Sullivan, who has retired to enter private practice.

J. C. PATTERSON, office engineer of the Erie R.R., has been appointed principal assistant engineer. The position of office engineer has been abolished. Mr. Patterson entered the service of the Pennsylvania R.R. in 1905 immediately after his graduation from Pennsylvania State College. In 1906 he entered the employ of the New York Central & Hudson River R.R., and was successively connected with the Big Four R.R., the Northern Pacific and the Chicago & Great Western R.R. until 1913, when he entered the service of the Erie as chief draftsman. In 1916 Mr. Patterson became valuation engineer of the system and in 1917 he was made office engineer, from which position he now succeeds to that of principal assistant engineer.

PROF. ALLEN B. MCDANIEL, head of the department of civil engineering, Union University, has entered the Government service at Washington, D. C.

E. H. PAGENHART, hydrographic and geodetic engineer of the United States Coast and Geodetic Survey, has been transferred by ex-

ecutive order to the Engineers Reserve Corps, with the rank of captain.

E. E. TALMADGE, who has been connected with the General Electric Co. for several years as a valuation and construction engineer, has received a commission as captain in the Quartermaster Corps, and assigned to duty at Richmond, Va.

The HON. H. H. WICKWIRE, who was appointed to the recently created position of minister of highways in the Nova Scotia Government, has been elected by acclamation as member for Kings County, confirming his appointment.

DR. D. B. STEINMAN, mentioned in *Engineering News-Record* of June 27, p. 1250, as having resigned from Waddell & Son, Inc., consulting engineers, New York City, to devote his entire time to his work in charge of the departments of civil and mechanical engineering, College of the City of New York, was employed by the firm as associate engineer. Dr. Steinman was not a member of the firm.

CHARLES E. ASHBURNER, city manager of Springfield, Ohio, since Jan. 1, 1914, will become city manager of Norfolk, Va., Sept. 1. He was the pioneer city manager, having filled that position at Staunton, Va., from April, 1908, to July, 1911, after which he was with the American Railways of Philadelphia at Lynchburg, Va., until he went to Springfield.

E. L. FLAD has been appointed construction superintendent and efficiency engineer of the Carnegie Steel Co. for the Youngstown district, succeeding F. Hubbard, who recently resigned to undertake construction work in connection with the new Government ordnance plant at Neville Island.

DR. WILLIAM C. WOODWARD, District health officer, Washington, D. C., since 1894, has resigned to become health officer of Boston, upon appointment by the Mayor. Doctor Woodward's resignation will take effect Aug. 1. He will be succeeded by Dr. William C. Fowler, the present assistant health officer. Doctor Woodward's service with the District of Columbia began in 1892, when he was appointed physician to the poor, after which he was appointed coroner, and in 1894 he became health officer. He is a graduate of Georgetown University, and is a member of the bar of the District of Columbia as well as of the District Medical Society. Doctor Woodward is a past president of the American Health Association.

PROF. F. B. SANBORN has resigned as head of the civil engineering department of Tufts College to devote all of his time to the business of the Sanborn Co., makers of scientific instruments, Boston. For the nine years previous to his appointment as assistant professor of civil engineering at Tufts College in 1899, Professor Sanborn was employed in engineering work by the Factory Mutual Insurance Cos. In 1901 he became professor of civil engineering at Tufts.

LIEUT. JOHN W. KELSEY, now on active duty at Camp McClellan, Alabama, has been appointed superintendent of the bureau of water, St. Paul water-works, through competitive civil service examination, and the position will be held open for him pending his return. Lieutenant Kelsey will succeed G. O. House, who resigned to become superintendent of the St. Paul City railway lines, as mentioned in *Engineering News-Record* of May 2, p. 885.

WILLIAM HOLDEN has resigned as engineer, department of streets and sewers, St. Louis, to become general secretary of the Commercial Club, Sioux City, Iowa. It is said that an engineer was selected for this position primarily to further industrial development and obtain better organization of industries for the production of war materials.

WILLIAM S. MOORE, Indianapolis, has resigned as state highway engineer of Indiana on account of the recent decision holding the state highway law unconstitutional and enjoining the Highway Commission from doing any work.

R. TRIMBLE and W. C. Cushing, who under private management were chief engineers maintenance of way of the Northwest and Southwest systems, respectively, of the Pennsylvania lines West of Pittsburgh, have been assigned by the new Federal manager of these lines to construction and maintenance, respectively, of all of his territory. Mr. Trimble's title is chief engineer—construction; Mr. Cushing's, chief engineer—maintenance.

F. C. BLACK, Hoquiam, Wash., was recently named city engineer of Hoquiam. Mr. Black has been a member of the high school faculty as instructor of mathematics.

L. RAYMOND SMITH, Jersey City, N. J., has been appointed by the United States Shipping Board as principal of its tenth marine engineering school, opened recently in Newark, N. J., to train men to become officers in the American merchant marine.

ALVIN HORWEGE has resigned as city engineer of Petaluma, Cal., to become assistant engineer for the Emergency Fleet Corporation of the United States Shipping Board, with headquarters at Alameda, Cal.

STEPHAN J. HAUSER has resigned as superintendent of the city filtration plant, Youngstown, Ohio.

F. L. STOCKBERGER, superintendent of the city garbage reduction plant of Cleveland since the administration of Newton D. Baker, has resigned to become associated with the Champion Stove Co. Charles C. Smith, of the municipal lighting plant, who was assistant superintendent of the garbage plant several years ago, will succeed Mr. Stockberger.

WILLIAM L. HAKER has been appointed resident engineer in the Seward division of the Alaskan Government Railways. He succeeds J. F. Waller, who has resigned to enter military service.

A. T. RHODES, street commissioner, Worcester, Mass., for the past five years, has been appointed field engineer of the Granite Paving Block Manufacturers' Association, with office at 31 State St., Boston.

W. R. B. WILLCOX, of Seattle, has been appointed superintendent of the Puget Sound Navy Yard Government housing program at Bremerton, Wash., under A. H. Albertson, also of Seattle.

OBITUARY

DANIEL C. CORBIN, pioneer railroad builder of Spokane, Wash., died of pneumonia in that city June 29. He was 83 years old and had lived in the West since 1862. Mr. Corbin built the Spokane Falls & Northern R.R., from Spokane to Nelson, B. C., and the Spokane International Ry., from Spokane to Kings Gate, Canada. He built and operated other and shorter lines in the mining districts in Idaho and Washington.

ROBERT BROWN CARNAHAN, JR., vice-president of The American Rolling Mill Co., was killed in an accident June 22. After his graduation from the University of Pittsburgh in 1891, Mr. Carnahan was actively associated with the Dewees-Wood Co. at McKeesport, Penn., from 1893 to 1899, when he went to the Homestead Works of the Carnegie Steel Co., soon after which he went into the present central works of The American Rolling Mill Co. as chief chemist and open hearth superintendent. It was under Mr. Carnahan's direction that Armco American Ingot Iron was developed. Mr. Carnahan was a member of The American Iron and Steel Institute, The American Institute of Mining Engineers and The American Society For Testing Materials.

S. F. MOELLER, civil engineer and contractor of Rockwell City, Iowa, died by accident June 25. Mr. Moeller was nearly 47 years of age and had been practicing for 20 years, specializing in drainage work. He designed and built some of the first drainage works in Calhoun County and at the time of his death was engineer for the Big Cedar Drain, a work calling for 150 miles of ditch and designed to reclaim 208,000 acres.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Developing Freight Routes on Highways with Motor Trucks and Trailers

Existing Detroit-Cleveland Line to Be Extended and Provided with Terminals, Feeders and Division Points

The use of motor trucks, with trains of trailers, capable of carrying loads up to 15 tons is a further development in relief of the railroads. A freight route of this kind was started between Cleveland and Toledo, and the return load procedure set forth in a recent issue of *Engineering News-Record* has been carried out from the first. The route was later extended to Detroit and eventually will be provided with terminals with feeder trucks, to gather and distribute shipments, as well as division points at intersection of routes where trailers will be routed to destination.

MOTOR TRUCK WITH TRAILER TRAIN ON OHIO FREIGHT ROUTE

The accompanying illustration shows one of the trains operated by the Liberty Highway Co., on its initial trip. The cargo carried one way is rims and springs, and motors are brought back on the return trip.

The service was started primarily to serve the automobile industry in that part of the state. Later it will be extended to handle all classes of freight. Between Toledo and Detroit, a distance of 70 miles, these trains have maintained a continuous service, making two trips in three days. The motive power is a Walter four-wheel drive tractor, manufactured by The Walter Motor Truck Co., New York City, with a capacity of five tons, and the trailers are 5-ton capacity, manufactured by the Troy Wagon Works Co., Troy, Ohio. There is a stretch of twelve miles of mud road in the Detroit-Toledo trip over which it is impossible to operate large and heavy motor trucks. The dividing up of the loads on the trailers makes it possible to follow the more direct route, whereas the Government was compelled to build a detour for its trucks. This is a practical demonstration, as pointed out by the Troy Wagon Works Co., of the original theory that trailers would make transportation possible over roads that would otherwise be impassable, and would cause less wear on good roads. This they point out is of vital importance in this day when the roads are taxed to their utmost.

These outfits run on a daily schedule, out of Toledo every morning at 8 a.m. and every evening at 10 p.m. each train carrying springs, bearings and other essentials of the automobile industry in Detroit. During the past four weeks the average load on each trip has been in the neighborhood of 12½ tons. The trip is made in from 7½ to 9 hours, weather and loading conditions affecting the time of the trips. The same program is carried out at Detroit, the trains leaving at the same hours, the only difference being in the character of the material hauled. Up to the present time, motors are being transported from Detroit to Toledo for use in an automobile plant in the latter city. On this trip each train carries 28 motors, weighing 650 lb. each. The motors are mounted in crates with 12 crates on each trailer and four on the tractor.

Plans are now being discussed for increasing the capacity of each train by installing another 5-ton trailer that will handle 12 more motors, which will bring the capacity of the train up to 40 motors, but at present 28 motors constitute a train-load shipment. The motors that leave Detroit in the evening are brought into the assembling

(Concluded on next page)

Japanese Foreign Trade in South America

Japan's export and import trade since the year 1913 has increased more than 120%. In 1913 the export to Chile amounted to about $121,000, in 1917 this was increased to $2,225,000; that to Argentine in 1913 was $1,364,000, in 1917 it was $3,471,000. Imports from Chile in 1913 were $2,773,000, in 1917 $9,015,000.

Prior to the war, although there had been a considerable immigration of Japanese colonists into South America, trade with that country was comparatively small. Since the war commenced the Japanese have taken prompt advantage of the shutting off of European trade, and have learned the needs of the South Americans as well as their convenience and wishes. They are sending men to study the business conditions and practices. These men are establishing banks and banking facilities and storing up raw materials, and in many other ways building up a stable market, which, it is believed, will last for many years after the war.

Wholesale Lumbermen Co-operating with the Government

The accomplishment of full coöperation with the Government is the purpose of Bulletin No. 8, issued recently by the National Bureau of Wholesale Lumber Distributers. They urge that "now is the time for the wholesaler to prove his economic necessity and his patriotism by assisting the Government and its agencies in carrying out the spirit of the Government orders regulating prices."

The bulletin states that the right of the wholesaler to participate in Government business is now conceded, but that compliance with certain rules is necessary, such as conducting the business through emergency bureaus and the furnishing of certain information regarding the supply of material, its origin, and points of shipment, etc. It is pointed out that unless wholesalers abide by the rules laid down by the Government board, especially in regard to prices, they will suffer accordingly.

Reserve Stocks of Portland Cement Reported Low

Smaller reserve stocks of portland cement than at any time in the history of the industry is reported. In the Lehigh district the entire daily output is shipped as it is made. Notwithstanding the cessation of the building trades generally, the Government demand is so heavy and so steady that there will be no replenishment of reserve stocks for a long time.

Large Salaries Reported by Federal Trade Commission

Salaries ranging up to more than $260,000 per year for presidents, vice-presidents, chairmen of boards of directors, office managers, accountants, etc., in the metal trades is interesting information included in the report on profiteering of the Federal Trade Commission to the Senate. It is pointed out that these amounts are exclusive of income derived from holdings of the various officials in the stock of the companies, and include only salaries and bonuses or "tantième" which have been charged to expense account. The highest salary was that of a president of one company, $364,326; vice-president, $221,596; chairman of the board of directors, $179,662; office manager, $148,530, and others ranking down the list to a minimum of $5200.

Payment of "Tantieme"

In a reply by the company regarding the "tantième" (a French word meaning a commission or proportional amount) it is stated that the payment of this is an established custom whereby the profits of the company are shared by the officers. The report of the Federal Trade Commission, however, states that these amounts formed a part of the expense account of the company.

Near the bottom of the list is an American name, a mining engineer in the West, receiving a salary of $6350. Close to him is a man with a German name in New York who receives a salary of $6190 for the position of "bookkeeper."

Report Is Comprehensive

The report of the Federal Trade Commission covers steel, copper, zinc, nickel, sulphur, lumber, coal, petroleum and its products, meat packing, leather and leather goods, flour, canned milk, and salmon canning companies, and in all of these an abnormal profit, since the war commenced, is reported. In one case, the volume of sales has been increased 150% only, whereas the profits have increased 400%, and it is pointed out that in a number of cases reports had been circulated of a dangerous shortage in the various commodities merely, it was asserted, to justify the high prices asked, this being especially alleged in the petroleum products and in leather. A number of steel companies have continued to make abnormal profits after the prices were fixed by the Government, although the prices were advanced in some cases up to 400% of the pre-war level when they were fixed.

That part of the report covering lumber states that this industry, except in one or two lines, does not show abnormal profits. This was pointed out in a recent issue of *Engineering News-Record*.

The report was submitted to substantiate the charge of profiteering made by the President in a recent address to Congress.

Freight Routes on Highways

(Concluded from preceding page)

room of the automobile plant in Toledo early in the morning, so that production continues without interruption. Tests have demonstrated that this tractor can handle three of these trailers over this road without undue difficulty, but should the 12-mile stretch of mud road become worse under weather and traffic so that three trailers would be too much for the motor, the trailers can be uncoupled and taken over the bad part separately.

In addition to this route, plans are now under way to extend the line to Pontiac, Mich., and also east of Toledo to include Akron, Canton, Alliance and Massillon, Ohio, the plan being to use trains running west of Massillon to a division point, which will most likely be Elyria or Norwalk, where the tractors will be unhooked from this train and the trailers coupled to the Michigan train for points north. In this way solid trains of trailers can be run through, while the tractors will only make half the runs. Thus an opportunity will be afforded for keeping them in good shape by eliminating the long grind. This, it is pointed out, inaugurates a manner of handling freight almost identical with that of the railroads.

The rates being charged between Detroit and Toledo are based on express rates, but where fixed amounts of tonnage are contracted for, lower rates are quoted. Negotiations have been practically completed whereby the Liberty Highway Co. operating these trains is to utilize the surplus space of the Troy Trailer warehouse in Detroit for a terminal. The line will be in a position then to handle miscellaneous shipments of all goods, the plan being to educate the Detroit shipper to bring smaller shipments direct to the terminal in Detroit; that is, on all shipments of less than two tons a pickup truck will be run to gather up the larger loads to make up the train. This plan is now in successful operation in Cleveland, by the Highway Motors Transport Co., although some difficulty was experienced at first in educating the public. The transportation difficulties were so large, however, they soon appreciated the fact that by resorting to this practice they were helping to build up the service.

Business Notes

G. W. Coleman, Boston, Mass., was appointed director of information for the Department of Labor June 30. He recently returned from a European tour in which he studied industrial problems in France and England especially.

Henderson W. Knott, formerly general manager of the Morgan Crucible Co., New York City, has been appointed by the United States fuel administration manager of the field force of engineers and inspectors who will work among the power plants of the country carrying out a campaign of instruction and inspection designed to bring the use of fuel for the production of power to the highest possible efficiency and economy.

Frank E. McDermit has been appointed receiver for the American Pipe and Construction Co., incorporated in New Jersey. The company is the owner of 17 subsidiary public utility companies. It is pointed out that the receivership was made not on the grounds of insolvency, but on the fact that it had been shown that the company was operating at a loss. The Federal courts of Pennsylvania appointed a receiver for this company last year.

Grace Motors, Ltd., with headquarters in Toronto, and branches in the principal cities of Canada, is now the Canadian distributer for the Sterling Motor Truck Co., Milwaukee.

The Crescent Truck Co., of Elizabeth, N. J., has purchased all rights, title and interest to the Crescent Electric Industrial Truck, from the Bethlehem Shipbuilding Corporation.

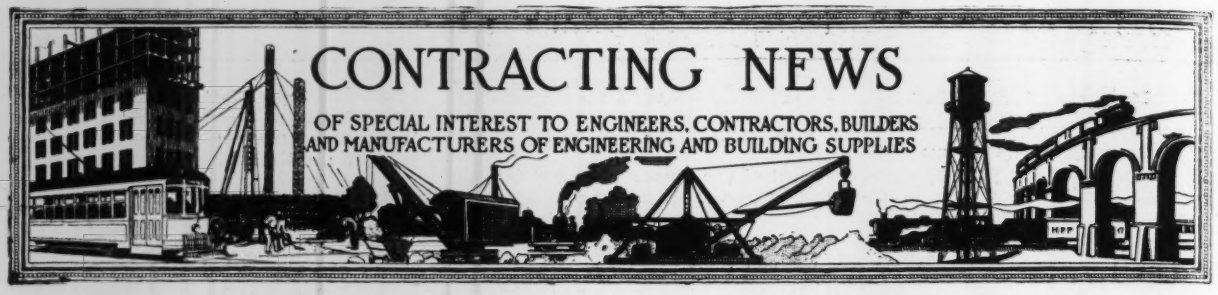
The Chicago Pneumatic Tool Co. makes the following announcements: L. C. Sprague, recently in the railroad department of the H. W. Johns-Manville Co., New York City, has been appointed special representative in connection with the sale of pneumatic tools to railroads. W. H. Callan, general plant manager, and W. P. Pressinger, general sales manager, have been elected vice-presidents of the company.

Trade Publications

"Motor Trucks of America, Vol. 6, 1918," has been received from the B. F. Goodrich Rubber Co., truck tire department, Akron, Ohio. It is a book, in pamphlet form, of 168 pages, containing a descriptive list of the motor trucks manufactured in North America.

A 20-page catalog of reversible ratchet wrenches has been received from the Lowell Wrench Co., Worcester, Mass. It illustrates this type of wrench in many sizes.

The C. H. & E. Manufacturing Co., Inc., Milwaukee, has issued a loose-leaf catalog of the saw rigs, pumps, hoists and mortar mixers which it manufactures. Besides numerous illustrations it contains diagrams and data sheets. These sheets are standard 8½ x 11, making it convenient to file the data.


CONTRACTING NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Proposals

For Proposals Advertised See Pages 54-56 Inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
July 15	Clovis, N. M.	July 11
July 15	Haledon, N. J.	July 11
July 16	Livingston, Mont.	June 27
July 16	Akron, O.	July 11

SEWERS

July 15	Clovis, N. M.	July 11
July 16	Leavenworth, Kan.	July 11
Aug. 1	Akron, O.	July 4

BRIDGES

July 15	Ukiah, Cal.	July 4
July 17	Prineville, Ore.	July 11
July 20	Tullulah, La.	July 11
July 23	Warrensburg, Mo.	July 11
July 24	Clarksburg, W. Va.	June 27
July 26	St. Louis, Mo.	July 11
July 31	Santa Domingo	May 16
Aug. 5	Duluth, Minn. Adv. May 16.	July 11

STREETS AND ROADS

July 12	New York, N. Y.	July 4
July 12	Jersey City, N. J.	July 11
July 15	Pineville, W. Va.	July 11
July 15	Peoria, Ill.	July 11
July 16	Detroit, Mich.	July 4
July 16	Ohio	July 4
July 16	Pittsburgh, Pa.	July 11
July 16	Sanford, Fla.	July 11
July 16	Jersey City, N. J.	July 11
July 16	Auburn, Neb.	July 11
July 16	St. George, S. I., N. Y.	July 11
July 17	New York, N. Y.	July 11
July 17	Chicago, Ill.	July 11
July 17	Grand Island, Neb.	July 11
July 17	Cleveland, O.	July 11
July 17	Brooklyn, N. Y.	July 11
July 18	Hastings, Neb.	July 11
July 18	Cleveland, O.	July 11
July 18	Spokane, Wash.	July 11
July 18	Newark, N. J.	July 11
July 18	Paris, Ill.	July 11
July 19	Bluefield, W. Va.	July 11
July 19	Newton, N. J. Adv. July 4 and 11.	July 11
July 19	North Platte, Neb.	July 11
July 19	Woodsfield, O.	July 11
July 19	Pennsylvania. Adv. July 4 and 11.	July 11
July 20	Gandy, Neb.	July 11
July 25	Indiana.	July 11
July 25	Bisbee, Ariz.	July 11
July 26	Indiana.	July 11
July 26	Pittsburgh, Pa.	July 11
July 29	Seattle, Wash.	July 11
July 29	Los Angeles, Cal.	July 11
July 29	Louisiana.	July 11
Aug. 1	Cleveland, O.	Mar. 28
Aug. 15	New Mexico. Adv. June 27.	June 27

EXCAVATION AND DREDGING

July 15	Cresco, Ia.	July 11
July 15	Palm Beach, Fla.	July 11
July 16	Rockwell City, Ia.	July 11
July 23	Albany, N. Y. Adv. June 27.	June 27
July 23	Yankton, S. D. Adv. July 11.	July 11

Bids Close		See Eng. News-Record

INDUSTRIAL WORKS

July 15	Norfolk, Neb.	July 4
July 15	Three Rivers, Que.	July 11
July 17	New York, N. Y.	July 11
Aug. 1	Racine, Wis.	July 11

BUILDINGS

July 15	Phila., Pa.	June 20
July 15	Cattaraugus, N. Y.	June 27
July 15	South Bend, Ind.	July 4
July 15	Norfolk, Neb.	July 4
July 15	Claremont, N. H.	July 11
July 15	Toronto, Ont.	July 11
July 15	Wanaque, N. J.	July 11
July 17	Schenectady, N. Y.	July 11
July 19	Cleveland, O.	July 11
July 20	New York, N. Y.	June 27
July 20	Windsor Locks, Conn.	July 11
July 22	Boston, Mass.	July 11
July 22	Mattapan, Mass. (Boston P. O.) Adv. June 27.	July 11
July 30	St. Louis, Mo.	July 11
Aug. 6	Richmond, Ky. Adv. July 11.	July 11

FEDERAL GOVERNMENT WORK

July 11	Receiving Barracks—Spec. No. 3147—Brooklyn, N. Y.	July 11
July 15	Water System—Spec. 3074—San Diego, Cal.	June 27
July 15	Electric School Ship Building—Spec. 3064—Hampton, Va.	July 11
July 15	Railroad — Spec. 3050 — White Plain, Md.	July 11
July 15	Submarine School — Spec. 3140—New London, Conn.	July 11
July 15	Generating Plant, etc. — Spec. 3129—Norfolk, Va.	July 11
July 15	Boiler and Mechanical Stoker—Spec. 3149—Brooklyn, N. Y.	July 11
July 15	Sand Handling Apparatus—Spec. 3174 — Washington, D. C.	July 11
July 16	Canals—Clint, Tex.	June 27
July 18	Post Office—Eldorado, Kan.	June 27
July 18	Supply and Distributing Systems—Shiprock, N. M.	June 27
July 19	Dredging — Philadelphia, Pa.	June 27
July 19	Jetty Repairs—Wilmington, Del.	June 27
July 22	4 Radio Buildings—Spec.	
July 22	Electric Power System — Spec. 3131—New York, N. Y.	July 11
July 22	Surface Condensers and Auxilary Pumps—Spec. 3085 — Puget Sound, Wash., (Bremerton P. O)	July 11
July 22	Pay Office and Paint Shop—Spec. 3109—Pensacola, Fla.	July 11
	3069—Haiti	June 20
July 22	Fuel and Diesel Oil Storage —Spec. 3071—New London, Conn.	July 11
July 22	Gunnery School, etc.—Spec. 3148—Pensacola, Fla.	July 11
July 25	Lockkeepers' Houses—Wheeling, W. Va.	July 4
July 29	Dispensary, etc.—Spec. 3188—Washington, D. C.	July 11
July 29	Dredging—New York, N. Y. Adv. July 4 and 11.	July 11
July 31	Assay Office—New York, N. Y. Adv. July 11.	July 11
Aug. 6	Dredging—New York, N. Y. Adv. July 11.	July 11

MISCELLANEOUS

July 15	Levee—Baton Rouge, La.	July 11
July 16	Steel and Pipe Line—Jersey City, N. J. Adv. July 4 and 11.	July 4

Bids Close		See Eng. News-Record
July 24	Telephones—Potsdam, N. Y. Adv. July 11.	July 11
July 25	Cement, etc.—Bisbee, Ariz.	July 11
Aug. 1	Levee—Baton Rouge, La.	July 11

Where name of official is not given, inquiries should be addressed to City Clerk, County Clerk or corresponding official.

WATER WORKS

In the matter of contracts from $100,000 up, the East leads the list by over $400,000, Pennsylvania being first with one contract of $700,000 at Yorktown for a concrete reservoir and pump well. Oklahoma is a close second with two contracts aggregating $535,000 and a third project of $100,000 to be voted on, all for new water-works. A trunk sewer at Corona, N. Y., is third at $346,493, and Texas fourth in the list with a gravity water supply and dam at $240,000, with Ann Arbor, Mich., at $200,000 next for the same purpose. Mitchell, N. D., and Milwaukee, Wis., are planning sewers and water-works at $185,000 and $150,000, respectively.

Proposed Work

Conn., Hartford—Bd. Water Comrs. soon lets contract for 4800 ft. 48 in. rein.-con. pressure conduit, built in place or precast pipe. C. M. Saville, 1026 Main St., engr.

N. C., Wilmington—City plans to issue $14,000 bonds to improve water works. F. F. Pilette, city engr.

Fla., Pensacola—City plans to vote on $100,000 bonds for water works system, etc.

Mich., Ann Arbor—Dept. Water Works soon lets contract laying 18,000 ft. 20 in. c. i. water pipe. G. S. Vandwarker, mgr. Noted Mar. 28.

Mich., Cassopolis—Village plans to improve water-works. Work involves one 80,000 gal. steel tank, one 350 gal. motor driven, centrifugal pump, one 750 gal. motor driven, centrifugal pump and chlorinating apparatus. Holland, Ackerman & Holland, 122 Fourth Ave., Ann Arbor, engrs.

Ill., Witt—City soon lets contract improving water works system. About $30,000. H. Hammack, clk. Noted June 27.

Minn., Argyle—See "Sewers."

Kan., Junction City—City having preliminary plans prepared to extend water and sewerage systems. Burns & McDonnell, 400 Interstate Bldg., Kansas City, Mo., engrs.

Kan., Lawrence—City passed ordinance to improve water-works system to include 16 mi. new mains. About $100,000 available for project. E. H. Dunmire, city engr.

Kan., Sedan—City plans to improve water-works system, involving 7,588 ft. new main, connections, etc., and lowering 2,000 ft. present main. Bonds for $14,209 will be issued for project. H. W. Loomis, clk.